SKY

Cleveland Star Party

The St. Mary's Meteorite of 1919

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Sky and TELESCOPE

CHARLES A. FEDERER, JR., *Editor* HELEN S. FEDERER, *Managing Editor*

In Focus

IF the sun were a star in the Large Magellanic Cloud, the nebula pictured on the back cover this month might well be one of the most conspicuous objects in the sky, its light so brilliant as to cast shadows of objects on the earth. It is the Great Loop or Tarantula nebula, which is visible to the naked eye as a bright portion of the cloud, known well by observers in the Southern Hemisphere where the cloud may be seen to best advantage.

According to Harlow Shapley, writing in **Galaxies**, the Orion nebula, so familiar to amateur telescope enthusiasts, is very small when compared to the Great Loop nebula; however, other galaxies have counterparts of the Tarantula. Red filters, which cut out the predominantly blue light of the bright nebulosity, have enabled us to discover a cluster of some 100 supergiant blue stars embedded in the Tarantula nebula, and probably these stars excite the nebulosity surrounding them to shine so brilliantly. Together the stars in the cluster are some 100 times as bright intrinsically as the globular cluster, M13, in Hercules — apparently each of these stars is singly as bright as the whole 100,000 stars in M13!

The Large Magellanic Cloud is at a distance of about 75,000 light-years, nearer than the Small Magellanic Cloud. In addition to the Great Loop nebula, it contains S Doradus, a peculiar variable star which is intrinsically about half a million times as bright as the sun.

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COVER: Long before the sun set, a large crowd had gathered on the lawn behind the Art Museum for the Cleveland **Press** star party on August 24, 1944. This is only a fraction of the 2,500 persons who observed that evening. Photo by Glenn Zahn, courtesy, the Cleveland **Press.** (See page 3.)

BACK COVER: A diffuse nebula of great intrinsic luminosity, known variously as 30 Doradus, NGC 2070, the Tarantula nebula, and the Great Loop nebula. (See "In Focus.") Photographed with the 60-inch telescope of Harvard's Boyden station, Bloemfontein, South Africa; exposure, 50 minutes, January 17-18, 1937, by J. S. Paraskevopoulos. North is at the right; the reproduction is enlarged 4.6 times from the original, which has a scale of 26.3 seconds of arc per millimeter; reproduction scale is therefore about 5.7 seconds per millimeter.

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(Left) The telescopes in action. Persons of all ages and walks of life patiently await their turns to view the moon. (Right) The author uses a searchlight which closely resembles a 6-inch richest field reflector. Note the battery which furnishes the current. The beam of light has been intensified in the reproduction.

CLEVELAND STAR PARTY

By James L. Russell
Cleveland Astronomical Society

On the 24th and 25th of August, the Cleveland *Press* held its fifth annual star party with a three-hour showing on each of two perfect evenings. These parties are sponsored by the *Press* under the direction of David Dietz, nationally known Scripps-Howard science editor. He is assisted by the writer, a Cleveland attorney and veteran vice-president of the Cleveland Astronomical Society, who handles the telescopes. The plan is to assemble as many telescopes as possible in a public park and invite the people to come and gaze at prominent objects in the sky. A sound truck is on hand with loudspeakers to carry the voices of astronomy experts over the park to the assembled public.

These parties are quite an undertaking and have gained national recognition. In past years we have learned how to handle the large crowds that annually turn out to view the moon and planets and listen to the lectures. The telescopes are furnished by the amateurs in the vicinity. Many are homemade. We have everything from little 6-inch reflectors to professionally made refractors with fine object glasses. Portability places the only limit on size. We have lately, however, had to eliminate the small reflectors. Homemade ones are apt to get out of adjustment easily, and we have a tough time keeping the curious from gazing down the tube at the mirror and obstructing the view entirely. A man once got his necktie caught in the prism holder and, in the confusion, the prism traveled in a trajectory of several feet, landing in the dust under the shoes of a small boy who promptly rubbed it off "clean," as he said, on his pants.

David Dietz, science editor, Scripps-Howard Newspapers.

Our telescopes are attended by their owners and one or two assistants for each, whose duty it is to keep the impatient lady about to view the moon from taking a strangle hold upon the eyepiece and upsetting the tripod, or at least spoiling the focus.

The telescopes are arranged in a big circle and the visitors are urged to form a line before whichever telescope they may prefer. A sound truck is placed in the center of the circle and the microphone is from time to time handed to visiting professional astronomers who, in turn, give impromptu talks on the heavenly bodies and constellations. We are greatly indebted to the boys at the laboratory at the General Electric Company at Nela Park for making us a very powerful searchlight, run from a storage battery on the ground. By means of its threadlike beam, the lecturer at the microphone is able to direct the listeners' attention to any part of the sky at will. Thus the people are kept interested while awaiting their turn at the eyepieces.

At the first party this year, Dr. J. J. Nassau, director of the Warner and Swasey Observatory, did a grand job at the microphone describing the heavens. Dr. Carl Seyfert, of the faculty at Case School of Applied Sci-

ence, formerly on the staff at Mount Wilson, also took the microphone from time to time and kept the public thrilled by answering questions.

The first party was scheduled for the 23rd of August, but we were rained out. We went back to the same place the following evening, drawing a beautiful, clear night. The response to Mr. Dietz' newspaper publicity was tremendous. Fathers, mothers, and children to the tune of 2,500 souls stood in line for hours to see through their favorite telescopes. While the lines moved slowly past the instruments, the sound truck blared forth with a review of facts about the moon and other objects, and acquainted the people with what they were about to see. Most people expect the image of the moon to be as big as a barn, and not a few are disappointed. It takes several minutes for some to grasp what they are looking at. Suddenly one will exclaim, " Oh my, now I see, just *look* at those holes! *Isn't* that wonderful!"

Our second party was held at a large park on the west side of town. This park is on the lake shore and, as the Park Department turned out the street lights for us, it made a wonderful setting. We had 5,000 at this party. A good time was had by all. Our sound truck was kept busy by Dr. O. L. Düstheimer, of John Carroll University, and Dr. Paul Annear, from Baldwin-Wallace College at Berea. These men did a fine job, explaining the heavenly bodies in simple language, and the public seemed to enjoy itself thoroughly.

The crowd included the usual pop vendors, crackerjack peddlers, and other elements not until now directly connected with astronomy. Youngsters on bicycles dashing through the crowds had to be suppressed as a menace to valuable telescopes, but babies in arms were admitted and, as usual, some person really interested had to stand by and wait until mama let little Joey "see" the moon.

The crowd thinned out in about three hours, and finally around midnight only a few diehards and cranks were left, and as all arguments were strictly prohibited, we could fold up and go home.

Just a few of the announcements, feature stories, and pictures printed in the Cleveland "Press" during the star party season.

METEORITE EXHIBITION OPENS IN MOSCOW

IN a cablegram received in September from the press service committee of the Soviet Scientists Antifascist Committee, we learn that a permanent meteorite exhibition has been opened in the Karpinska Geological Museum, Moscow. It consists of the meteorite collection of the Academy of Sciences, U.S.S.R., and contains more than 1,200 specimens obtained from some 200 meteorites, many of which have fallen outside of Russia.

The 10 largest of the meteorites are displayed in a separate case and one's attention is drawn to a pallasite iron specimen weighing upwards of half a ton. This specimen was found in 1734 on the banks of the river Yenisei in Siberia. Also, there is on display the largest iron meteorite in the world to have fallen at night before witnesses—two pieces, one weighing 199 kilograms and the other 58 kilograms, were found immediately.

The Kainzas meteorite is the largest of about 20 stones which were found after the meteorite shower of September 13, 1937. It weighs 102.5 kilograms, while the smallest stone from this shower in the display weighs only seven kilograms. The Kainzas has a remarkable shape and structure.

Small meteorites are displayed in five cases. The first contains specimens illustrating the shapes of meteorites, and types of crusts and surfaces. Noticeable for their streamlined shape, resembling the head of a shell, are the Karakol stone meteorite which fell on May 9, 1840, in Semipalatinsk province, and the Repeyev Khutor iron which fell August 8, 1933, in the Stalingrad region. The streamlining is a result of the melting and flowing of the meteoroid's forward surface as it collides with the resisting atmosphere.

Another case illustrates types of meteorite structure and composition. The chemical and mineralogical compositions are shown by tables. Some cases are devoted to meteorite showers. About 100 stones with a total weight of 65 kilograms were found after a shower in the Ivanov region on December 26, 1933. Diagrams illustrate the process by which meteorites break up into showers in the earth's atmosphere.

A special group consists of meteorites collected from craters on the earth's surface produced by the fall of meteorites weighing scores of tons.

A Trainer for Celestial Navigation

By Harry LeVine, *1st Lt., A.C.*
Peterson Field, Colorado Springs

THE stimulus of war has produced a great, popular interest in navigation. The public's imagination has been captured by the thought of miles of uncharted lands and vast stretches of sea which confronted military aircraft; thus aerial celestial navigation, independent of all terrestrial check points, matured overnight.

College courses in practical astronomy and astrophysics were forced into the background by floods of students who oversubscribed navigation classes. Planetariums turned their facilities over to the teaching of celestial navigation, and numerous books on all phases of navigation appeared on the market.

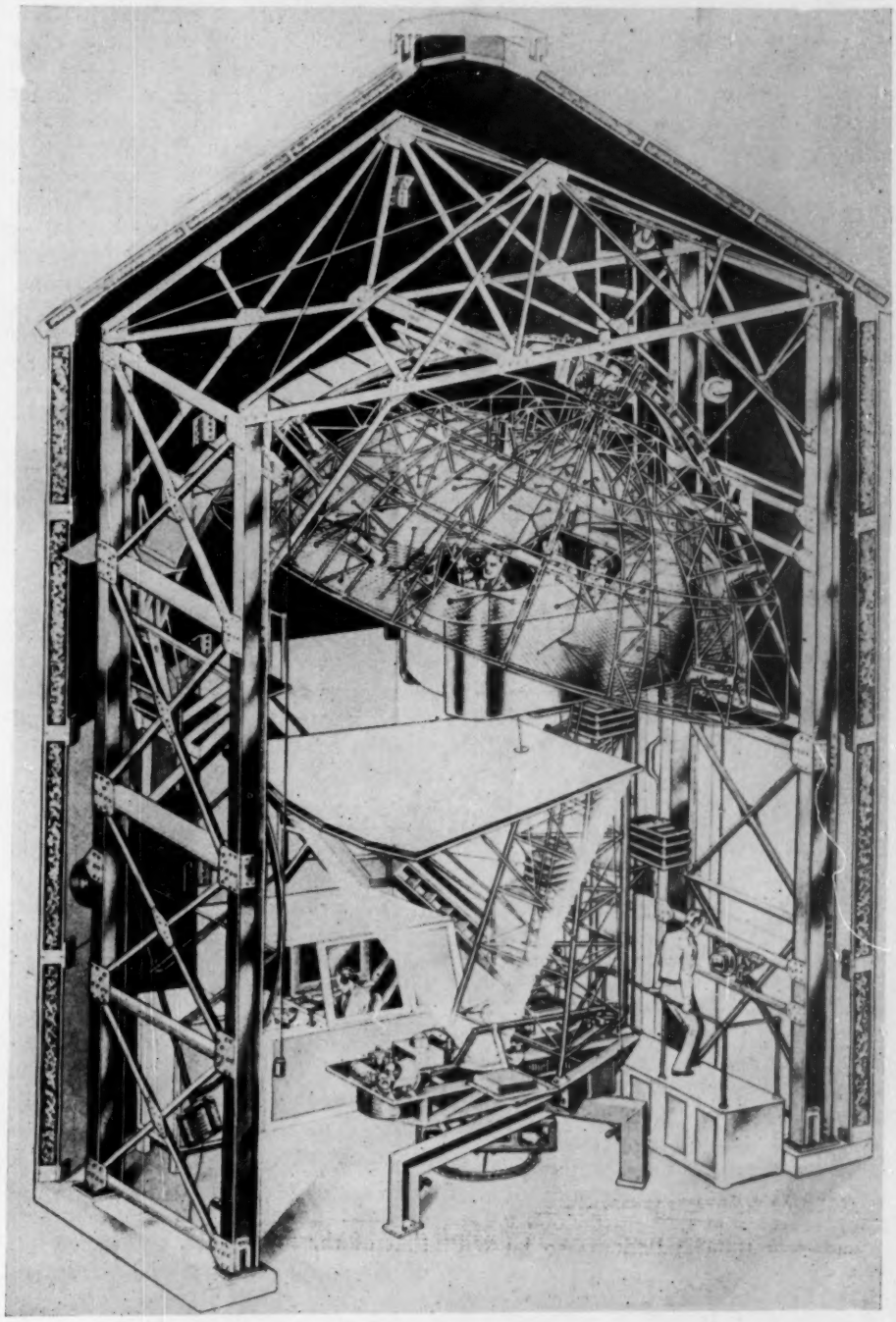
Within a few months after Pearl Harbor, the armed services used up the available college men with a proper background of science and technology to make them good celestial navigators. It became necessary to develop high school graduates and there arose the need for aids which would reduce the problems involved to their simplest forms. It was also important to have a means whereby the embryo navigator could practice without endangering airplane and life —and to avoid his having to wait for safe flying weather. A device designed for these purposes is the Link Celestial Navigation Trainer.

In a lesser sense, the major component of this machine is composed of a planetarium, or a dome which revolves 35 feet above the floor. Upon this hemisphere are the principal northern constellations whose declinations lie above 35° north. Each body is placed upon the sphere according to its sidereal hour angle (360° — right ascension) and declination. While there are 320 stars represented in all, actually only a dozen of the customary navigation stars are observed. Unlike a planetarium, where the images are projected upon the sphere, these bodies are actually in the sphere and project their rays down. The navigation stars which can be observed, Polaris, Deneb, and others, emit parallel rays of light, thus simulating the conditions as actually found (so far as navigation matters are concerned). A bubble sextant is used.

Since the navigation dummy airplane is stationary, the dome must not only move for the diurnal motion of the stars, but for the airplane's movement over the earth. Accordingly, if a flight is due north or south, then the dome will move for sidereal time. If the flight is due east, however, then the dome must be speeded up to compensate for the additional apparent motion of the stars to the west. As the airplane takes up a course which involves a change in latitude, then the dome moves up or down so as to place the heavens in their proper apparent positions for the changes of latitude and longitude involved.

The dummy airplane, which carries both a "navigator" and a "pilot," revolves through 360 degrees and

(Continued on page 9)



Detail drawing of the Link Celestial Navigation Trainer.

ARISTOTELIAN COSMOLOGY

or

A Romance of Manhattan

By Joseph R. Habes, S.J.
West Baden College

Photo by Edward Ratcliff,
Rockefeller Center Roof Studio

Manhattan bright lights, the Chrysler tower, and the stars, as seen from Rockefeller Center Roof.

IT is a clear night. The breeze is warm and caressing. High above the glittering and noisy streets of New York City—some 70 stories up—you are resting comfortably on a roomy Rockefeller Center Building terrace. With your head tilted back on a de luxe sofa, you are contemplating the starry firmament, understanding the wonderful construction of the universe as explained by modern scientists today . . . .

. . . . Suddenly, to your utter amazement, a ghost appears from out of the night. To your greater amazement, the ghost comes in your direction, draws up a chair on the terrace, and begins to speak to you in a low, solemn voice: "My friend, fear not, for I am the ghost of Aristotle. I have come from the nether world to give you a brief description of the universe as I conceived it 2,000 years ago.* My time is limited; so let me begin by dividing the entire cosmos into two parts: 1) the terrestrial or sublunary region and 2) the celestial region of the heavenly bodies.

"The four elements, *earth, water, air,* and *fire,* formed the terrestrial domain. The heaviest element and the most imperfect of all bodies was the earth, a solid, situated at the center or bottom of the universe, immovable and spherical in shape. Water, air, and fire, according to their weight, surrounded the earth in spherical layers or hollows, one above the other. These elements were not eternal but subject to generation and destruction, subject to continual changes through the strife of those elements and their incessant mutual transformations. So much for my terrestrial realm which was actually a small part of the universe.

"Now let us turn to that other region, namely, the celestial world. This was composed of a fifth element, *aether,* which occupied the whole region from the orbit of the moon to the outside limit of the universe. This element was superior to the others in proportion to the greater perfection of circular motion and its greater distance from the earth. Moreover, it was divine, without beginning or end, imperishable, incapable of increase or change.

"All the bodies in this ethereal domain were carried around the earth, as the central point of the universe, in a series of concentric, hollow spheres or shells. They were technically called *the heavens.* We had seven such heavens, one outside, or if you will, above the other; and according to my own personal conception—I loved to differ from the Pythagoreans — the relative order of those planetary spheres was as follows: Moon, Sun, Mercury, Venus, Mars, Jupiter, and Saturn. Outside of these again was an eighth heaven, that of the fixed stars, the uppermost of all and nearest to the circumference or top of the universe.

"On the periphery of the universe was located the *primum mobile.* It caused eternal motion lasting for an infinite time and was, therefore, indivisible, without parts, and had no magnitude. The diurnal rotation of the eighth heaven from east to west, received from the *primum mobile,* was communicated to the seven lower heavens in addition to their own several proper rotations which were all in the converse direction, namely, from west to east.

"On the one hand, the sun, moon, and planets required a multiplicity of spheres to explain their various proper movements. In view of this, I adopted the concentric sphere hypothesis of good old Eudoxus—may the gods rest his shade—but added 22 fresh spheres, making 55 in all, to account for the reacting and disturbing effect of one sphere on another. Each composite and deviating motion of theirs was attributed to an incorporeal entity, subordinate, however, to the *primum mobile.* On the other hand, the revolution of the fixed stars was the most perfect motion of the celestial world. Stationed next to the Deity, in its single sphere, it carried around an innumerable multitude of heavenly bodies. Its motion was the swiftest — pure, unalterable, of uniform rotation, embracing all and generating all motion. This sphere and the planetary ones were in constant motion but the stars and planets themselves remained stationary and carried around by them. However, it was always my conviction—despite the opinion of others—that the supposed harmony of these spheres was merely an elegant and poetical conception.

"The heavenly bodies were not dead masses but beings, animated by rational spirits, because their substance was aether, that fifth element, or *quinta essentia,* immutable and indestructible. They only seemed bright, like fire, because the friction caused by the rapidity of their rotation made them incandescent. The sun, moon, and stars were spherical, eternal, intelligent, divine — living beings un-

*The speech of Aristotle is based on his astronomical views, expressed principally in two treatises—the **Meteorologica** and the **De Caelo.**

wearied, and in the enjoyment of perfect happiness.

"In conclusion, then, and in general, my universe was eternal, spherical in shape and finite, because any body which has a circular motion, as the universe, must be finite. The universe was one only, and complete, containing all matter that existed. For all the simple bodies moved to their proper places, earth to the center, aether to the outermost region and the other elements to the intervening spaces. There was no simple body outside the universe because that body had its natural place within. There was no space or void outside the universe, for space or void was only that in which a body was or could have been.

"And so, my friend, this was my universe. Although it may appear to you a fantastic mechanism, be not too critical in your judgment. For, remember, science had not made such progress as it has today and I was forced to construct a cosmos according to philosophical premises, which proved to be, in the face of modern astronomy, very inaccurate.

"But, say, I must be gone. My superiors have given me permission to speak only a thousand words and now, from this skyscraper lounge, I must return to Hades, the paradise of all good philosophers." And in so saying, the ghost of Aristotle vanishes into the night . . . .

. . . . The terrace is deserted. The stars of Manhattan are twinkling overhead. It is a clear night. The breeze is warm and caressing. . . .

ASTRONOMICAL ANECDOTES

ASTEROID NAMES AND QUESTIONABLE NOMENCLATURE

ALMOST six years ago, Dr. A. C. D. Crommelin expressed disapproval of the name Hermes for the unnumbered asteroid 1937 UB, because the Roman equivalent, Mercury, is assigned to a major planet. A number of somewhat similar instances came to mind, and, after looking over the names of all the asteroids, I came to the conclusion that Dr. Crommelin was somewhat late with his complaint.

Another new, as yet unnumbered asteroid, Apollo, and 895 Helio suggest the sun. For Venus, there are 1388 Aphrodite and 30 Urania. For the moon, there are 105 Artemis, 672 Astarte, 78 Diana, 100 Hekate, and 580 Selene. The earth is represented by 1184 Gaea.

The satellites of Jupiter are found in 85 Io, 52 Europa, 1036 Ganymed, 204 Kallisto; those of Saturn in 577 Rhea and 106 Dione; one of Uranus in 593 Titania.

In stellar astronomy, we have 233 Asterope, 130 Elektra, 66 Maja, and 1051 Merope, for the Pleiades; 849 Ara and 491 Carina for the constellations of the same name; perhaps 5 Astraea or 1 Ceres might be connected with Virgo, 38 Leda with Cygnus, 204 Kallisto with Ursa Major.

Among the asteroids themselves there are many instances of names and their epithets or appellatives: 1221 Amor, 433 Eros, 763 Cupido; 881 Athene, 93 Minerva, 2 Pallas; 1 Ceres, 1108 Demeter; 94 Aurora, 221 Eos; 103 Hera, 3 Juno; 46 Hestia, 4 Vesta; 399 Persephone, 26 Proserpina; 639 Latona, 68 Leto; and, perhaps, 5 Astraea, 269 Justitia.

Some years ago I made up a list of the asteroid names in alphabetical order and in passing I had jotted down the examples above. It would probably be the better part of wisdom for the International Astronomical Union to take the situation in hand with a few cleanly cut directives concerning asteroidal names, to prevent the complete escape of the situation from control. I can't help being worried about the meaning of the asteroid 1100 Arnica! I was bothered a bit about 694 Ekard, too, until I learned that it is a reversed spelling of Drake, for the university at Des Moines of the same name.

Anyone may be expected to recognize the significances of 1000 Piazzia, 834 Burnhamia, 1058 Grubba, and 1286 Banachiewicza. On the other hand, a non-American of a generation hence may be puzzled by 932 Hooveria; an American volunteer student of asteroids is signified in 1230 Riceia; an American brewer who gave his money and his name to a college for women is found in 1312 Vassar; Harlow Shapley's daughter has a namesake in 878 Mildred. Most outstanding of all, perhaps, is 1252 Celestia, which was named, despite other possible opinions, not because of the astronomical sound of the name alone, but for the mother of Dr. Whipple of the Harvard College Observatory.

In the British journal, *Observatory*, for 1885, there is an advertisement: "Herr Palisa, being desirous to raise funds for his intended expedition to observe the total solar eclipse of August 1886, will sell the right of naming the minor planet No. 244 for £50." I have looked in vain for a sequel to this; asteroid 244 bears the name Sita, but whether someone paid more than $200 for the privilege of assigning that name, I have never learned.

Since starting to type the copy for this installment, there has been a thought in my mind that it is really unfortunate that the word *asteroid* came into the literature for these objects that should always be referred to as planetoids or minor planets. They are small planets, not small stars; indeed, the word planetoids is not good, for the suffix -oid (from the Greek *eidos,* meaning *form*) implies "like" in English. These bodies are not properly said to be "like planets" for they *are* planets, though minor ones.

And this sort of thing has an almost unlimited chain of consequences. There are many fragments of questionable nomenclature in astronomy. Scientists are able to establish communication of ideas with each other by adhering to a formalized vocabulary. In the opinion of many of us, it is most regrettable to find ourselves slipping into such expressions as "the moons of Jupiter." Jupiter has Io, Europa, Ganymede, Callisto, and seven others unnamed; we have the moon. That is the name of our satellite, as those others are the names of the satellites of Jupiter.

And then, if we say Jupiter, with a capital J, why must we say earth with the little e? Deimos and Phobos get big D and P but moon must be content with a little m! Arcturus and Polaris get big A and P but the most important star in the universe must take a little s—the sun. Editors tell us that it is because we use the article *the* before the words sun, earth, moon. We also use the article, as Dr. Olivier points out, before the name of our country, yet an editor's eyes would bug out if he ever saw "the united states of america" in an article! To say "the british empire," "the soviet union," "the republic of france" makes any dependence on the definite article seem rather silly.

A particular planet is Earth or the Earth; earth is dirt or soil. A particular satellite of the solar system is Moon or the Moon; we might agree that it will remain quite all right to say that moonlight streams in the window. The Sun, our particular star, is sometimes hidden behind the clouds and we might be permitted to say that then there is no sun; it would be better to say there is no sunlight to cast shadows when the Sun is behind the clouds.

Anybody want to join my revolution? R.K.M.

NEWS NOTES

By Dorrit Hoffleit

THE PROPER MOTION OF h PERSEI

In 1908, J. C. Kapteyn suggested to Adriaan van Maanen, a student at Utrecht, that he measure plates taken at Helsingfors and Poulkovo to study the proper motions of stars in the Double Cluster (h and Chi) in Perseus. Kapteyn and de Sitter had some years previously measured the parallaxes of 178 stars in this region and had concluded that, as soon as the cluster stars could be certainly differentiated from the field stars in the apparent vicinity, the parallax (hence, the distance) of the clusters relative to the background stars could be determined with certainty. In his early thesis, van Maanen found, however, that since the proper motion of the clusters is only a few thousandths of a second of arc, his results for the individual stars were not sufficiently accurate to indicate which of the stars did and which did not belong to the clusters.

Returning to his "first love," van Maanen has now investigated the h Persei cluster at Mount Wilson, measuring pairs of plates separated by intervals of 29 and 17 years. These afford higher precision in the determinations of the small motions. Even so, he comments that Kapteyn's and de Sitter's "optimistic view is hardly realized by the present results." He has measured 800 stars for proper motion in the central region of h Persei with a probable error of 0".00067 in each co-ordinate. Over 100 of the stars were found not to belong to the cluster. The proper motion of the cluster as a whole is found to be +0".0016 ±.0005 in right ascension and —0".0033 +.0002 in declination.

EDWARD BAUSCH

American scientists, including astronomers, owe an immeasurable debt to the late Edward Bausch, prominent manufacturer of optical equipment, who died in Rochester, N. Y., on July 31st at the age of 89. It was he, more than anyone else, who was effective in breaking the European monopoly on the production of optical glass and the manufacture of precision optical instruments. When Dr. Bausch entered his father's firm (the Bausch and Lomb Optical Company) in 1874, and began the manufacture of microscopes, it is said that there were only 18 microscopes in America. Germany had an almost unquestioned monopoly on the production of fine optical equipment. During the first World War, Dr. Bausch and his brother set up a plant in Rochester for making precision optical glass, the first outside Europe to provide this important war material. Since that time, Bausch and Lomb has maintained a record for consistently high-quality production, which has been of vital importance in the present war effort.

NEW WHITE-RED DWARF DOUBLE STAR

W. J. Luyten and his co-workers at Tucson, P. D. Jose and J. F. Foster, report the discovery of a star of nearly 16th photographic magnitude whose color index (+0.1) and large proper motion (0".29) imply that it is a white dwarf. The star is accompanied by another star 37" away, of 17^m (pg) and color index +1.5. Thus we have a double star consisting of a red and a white dwarf.

THE LUNAR ATMOSPHERE

The moon always presents a sharp-appearing edge, without any haze, such that occultations can be accurately observed as the instantaneous disappearance of point-like star images which have not suffered any diminution in brightness as they approached the lunar limb. Hence, it has been generally assumed that the moon does not have any atmosphere at all. Some astronomers have, however, conceded that the moon might nevertheless have an atmosphere equivalent in mass to about a 1-centimeter thickness of terrestrial atmosphere at sea-level density. This general conclusion seems supported by a recent investigation by the Soviet astronomer, V. G. Fessenkoff. From measurements of the polarization of light from the moon, he finds an upper limit for the mass of the moon's atmosphere to be 10^{-6} times the mass of the earth's atmosphere. This would amount to roughly 5×10^9 metric tons of atmosphere.

ASTRONOMER AWARDED AZTEC EAGLE

Dr. Harlow Shapley, director of Harvard College Observatory, has been awarded the Order of the Aztec Eagle, third class. This is the highest decoration awarded to non-Mexicans by the Mexican government. The honor comes in recognition of his helping to advance scientific co-operation between the United States and Mexico and in aiding the National Astrophysical Observatory at Tonanzintla in securing one of the best modern-type telescopes and other equipment.

STRANGE ECLIPSING BINARIES

Discrepancies among the results of analyses of different kinds of data frequently lead to interesting new discoveries. In the case of eclipsing binaries, examples have been found in which the photometric light curves indicate nearly circular orbits while the Doppler shifts in the lines of the spectra of the stars indicate definitely eccentric orbits. Two remarkable pairs of this sort, U Cephei and SX Cassiopeiae, were particularly discussed by Dr. Otto Struve, director of the Yerkes and McDonald Observatories, in his address as retiring vice-president and chairman of Section D of the American Association for the Advancement of Science. His paper was presented at the meeting of Section D held in Cleveland, Ohio, on September 14th.

Part of the program of the meeting included a symposium on objective-prism spectra, a subject contrasting with Dr. Struve's consideration of the fine details in stellar spectrum analysis for which fairly large instruments are necessary. The symposium discussion was concerned more with the results that can be attained for large numbers of faint stars not easily studied with high dispersion.

In solving the mysteries of the strange eclipsing stars, two valuable new tools, known as the method of the dilution effect and the stellar rotation method, were employed by Dr. Struve. The dilution effect permits one to determine whether an absorbing mass of gas (recognized by its spectral lines) is on the surface of a star or at some distance above the surface. The relative intensities of lines whose dilution is to be determined are compared with the lines in an ordinary stellar atmosphere. The rotation effect serves in the nature of a spectroheliograph, the instrument whereby limited portions of the sun's surface and atmosphere may be observed in detail and the results combined into a composite picture, if desired. Because of the Doppler effect (spectral lines being displaced from their standard positions in accordance with the relative speed of approach or recession of the source of light), every

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The St. Mary's Meteorite of 1919

By Francis D. Cecil

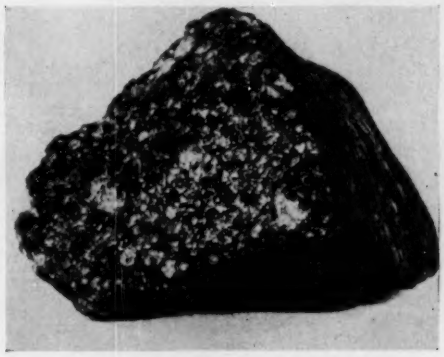
Dept. of Astronomy, Maryland Academy of Sciences

LATE one afternoon in the summer of 1919, the sky over southern Maryland was suddenly parted by a fiery, smoke-trailing meteor. Many of the country folk living in that region saw the object and for days afterward talked about it. One man said it looked about the size of a cantaloupe. Another declared it left a streak of fire behind it. Still another observed heavy layers of black smoke in the sky during and after the event. All agreed that it was a startling occurrence and some were nearly frightened out of their wits. For not only did the meteor present an awesome appearance, it also made a loud and thunderous noise.

A few days after the meteor was seen, a retired sea captain, John Forrest by name, called upon the writer's grandfather who lived in a little town called Great Mills. Capt. Forrest related that he had been working in his field near the town of Ridge farther down the peninsula, that he had observed the meteor in flight, had seen it explode, and that a piece of it struck the earth barely 20 feet in front of him. Furthermore, he recovered the piece and carried it into his house. He was willing to share it, so he broke off a fragment and gave it to my grandfather. It was this fragment which I obtained for study after it had lain in an old pendulum clock for 17 years.

The specimen has been definitely recognized as a stony chondrite. It weighs 24.25 grams, has a specific gravity of 3.24, and is composed chiefly of enstatite and chrysolite (olivine). Iron is present, though in rather small quantity. The object is pyramidal in shape and measures 30 x 25 x 25 millimeters. It has three smooth surfaces and one broken. Over the smooth or natural surfaces is a thin, black coating such as is often observed in stony meteorites. The broken surface is dark gray and reveals numerous chondrites and phenocrysts ranging in size from tiny points up to nearly two millimeters.

The path of the meteor in the sky was from southwest to northeast and, depending upon the observer's locality, presented varying angles with the horizon until at Ridge it appeared to be directly overhead. At the time it exploded, according to Capt. Forrest, it was over Chesapeake Bay and most of the fragments are believed to have fallen into its waters. As to the actual size of the meteor there is little evidence; the tremendous concussion produced by the object suggests that it was fairly large, though certainly not as large as claimed by one man who said a piece of it fell into the deep water of Chesapeake Bay and protruded 20 feet above the surface.



The phenomenon of sound following a meteor is a matter that mystifies many people, principally because the meteor is traveling so many times faster than sound. After the object has disintegrated or passed on, one will hear a long rumbling noise like distant thunder rolling along the sky. This sound will start at the point where the meteor was nearest and go back toward the point from which it came. Then, as the sound arrives from the earlier parts of the path, it will seem to reverse itself and roll in the opposite direction. Persons, therefore, who did not see the meteor but only heard it, will not agree on the direction in which it was traveling. Some will say it went one way and some the other. But if we remember that sound travels much slower than a meteor, we realize that the sound of the approaching meteor must come long after the meteor has gone. Sometimes it is a matter of minutes before the approaching sound is heard and still other minutes before the departing sounds have ceased. In the case of the St. Mary's meteor, the writer recalls that the sounds followed the above pattern.

The effect of the St. Mary's meteorite on the tranquil, easy-going people of the region was remarkable. A boy, up in a cherry tree, saw the fiery visitor, and thinking the world was coming to an end, he clambered down the tree and ran home. A man, feeling that the same dire event was at hand, advised his hearers to prepare to meet their Maker. And a housewife who had just stepped into the yard thought the meteor was a bomb.

There is another piece of the meteorite somewhere in southern Maryland. It is the piece from which the available fragment was broken, but repeated efforts by the writer to locate it have failed. Either Capt. Forrest, who is now deceased, gave it to someone or it was thrown away by mistake. A visit to Capt. Forrest's home and a thorough search of the premises failed to reveal its whereabouts.

In the meantime, the extant fragment reposes in a glass case at the Maryland Academy of Sciences in Baltimore. It is a small object, indeed, but it is the only thing that can prove the St. Mary's meteorite really happened and that it was genuine. Looking at it now, I find it difficult to believe that anything so small could have been part of that fiery object which shattered the peace and quiet of southern Maryland 25 years ago.

A TRAINER FOR CELESTIAL NAVIGATION

(Continued from page 5)

pitches on a universal joint. The navigator can pick any heading and determine by celestial fixes his position, drift, wind, and so forth. The actual time units involved in real flight are conformed with, so that at 160 knots it takes one hour to affect a change in the position of the stars equal to 160 nautical miles over the earth.

As the student progresses, his work can be analyzed and he can be taught as he works, or else he can be left to fly to what would in an aircraft be his own destruction, but without any ill effect to himself and crew. It is also possible to fly dead-reckoning, radio, and pilotage flights in the trainer. Thus, the navigator may "take off" in the afternoon, fly on dead reckoning, pilotage, and radio, and reach his destination on celestial.

A number of these machines are to be found at each heavy bomber crew training base. As yet it is impossible to simulate the moon or the planets, but this device might be the postwar answer to those who wish to fly around the world while staying at home—provided one can afford the cost of $50,000 per machine.

Amateur Astronomers

BOND CLUB TO CELEBRATE 20TH ANNIVERSARY

THE 20th anniversary meeting of the Bond Astronomical Club is to be held at Harvard College Observatory on Friday evening, October 6th, with members of the American Association of Variable Star Observers as guests. On Saturday the variable star group will hold its annual meeting, with sessions for papers during the day.

The Bond Club was founded in 1924 as a popular astronomical activity under the sponsorship of the Harvard Observatory. Many noted astronomers have lectured before the club on subjects not only of the lighter vein, but also more technical on occasion. The club derived its name from the first two directors of the observatory, William Cranch and George P. Bond, father and son. For many years Miss Elizabeth Bond, daughter of George P. Bond, was sole honorary member of the club. The present secretary of the society, Miss Miriam Bond, is a direct descendant of the Bonds.

For a number of years, the club sponsored Open Nights at the observatory, especially making provision for visits by school children. One of the club's greatest contributions to the furtherance of popular interest in astronomy was the publication of *The Telescope*, in recent years joined with The SKY as *Sky and Telescope*. It is expected that a number of prominent persons now or formerly active in Bond Club affairs will attend the anniversary celebration.

The joint meeting with the A. A. V. S. O. follows the custom of past years. A meeting of the council of the A. A. V. S. O. will be held on Friday, and if facilities are available, there will be a dinner on Saturday night.

THIS MONTH'S LECTURES

Chicago: The Burnham Astronomical Society will meet on Saturday, October 28th, at 8:00 p.m. in the La Salle Hotel. The speaker will be Charles A. Federer, Jr., Harvard College Observatory, and his subject is "Observational Methods —Old and New."

Cincinnati: Dr. J. J. Nassau, director of Warner and Swasey Observatory of the Case School of Applied Science, Cleveland, will address the Cincinnati Astronomical Association on Friday, October 13th. His subject will be, "The Program of the 24-inch Schmidt Telescope." The meeting convenes at 8 p.m. at the Cincinnati Observatory, Observatory Place.

Detroit: On Sunday, October 8th, Prof. W. Carl Rufus, acting chairman of the department of astronomy at the University of Michigan, will speak to the Detroit Astronomical Society on "The Beauty and Mystery of the Northern Lights." The group meets at Wayne University, Room 17, at 3 p.m.

Indianapolis: At a meeting of the Indianapolis Astronomical Society on Sunday, October 29th, Charles A. Federer, Jr., Harvard College Observatory, will speak on "Little Stars and Big Ones." The meeting is to be held at 2:15 p.m., in Odeon Hall.

Madison: The annual report of officers of the Madison Astronomical Society will be given at the meeting on Wednesday, October 11th, at the Washburn Observatory. Then there will be a discussion of the features of the October sky, followed by a talk on "Our Place in the Milky Way," by Dr. C. M. Huffer, of the University of Wisconsin.

New York: On Wednesday evening, October 4th, Charles A. Federer, Jr., Harvard College Observatory, will speak to the Amateur Astronomers Association on "Trends in Navigation." The meeting is at 8:15 p.m. in the Roosevelt Memorial lecture hall of the American Museum of Natural History.

YAKIMA, WASHINGTON

The Yakima Amateur Astronomers are still active despite a wartime loss of our modest membership. I am practically the only active telescope maker left, although I have instructed a new member in the art. Also, a woman member of the club has successfully completed a 6-inch mirror.

We were sorry to read of the Tacoma amateurs disbanding for the duration. We intend to keep plugging away. Already we've had several public "Sky Nights" for observation this year.

O. E. THOMPSON, president
Yakima Amateur Astronomers

AMATEUR ASTRONOMERS ASSOCIATION

New York City

CLASSES conducted for and by members of the Amateur Astronomers Association will begin the week of October 9th. Those interested in obtaining further information regarding membership in the society and attendance at classes should communicate with the secretary, George V. Plachy, American Museum of Natural History, ENdicott 2-8500. At the time of going to press, the following classes were definitely scheduled:

Appreciation of Astronomy, conducted by Peter A. Leavens on the 3rd Wednesday of each month, with outdoor observing.

Elementary Astronomy, by Edgar Paulton, every Thursday; a class for those wishing a regular course in introductory astronomy.

Practical Astronomy, by Luther G. Schimpf, alternate Mondays, covering astronomy as applied in navigation.

Physics Review, by Antoinette Pridmore, every Monday; provides a review of the fundamentals of physics as applied in astronomy.

Mathematics Survey, by Samuel C. Silver, every Tuesday; reviewing algebra, geometry, and trigonometry, in accordance with the general needs of the class.

Seminar in Astrometrics, by Leon E. Gold, every Friday; a group concerned with methods used in astronomical measurements and the principles of the instruments involved.

Telescope Mirror-Making, conducted by Messrs. Lojas, Luce, Singer and Thompson. Sessions on Tuesdays, beginning October 17th, 7 p.m. to 10 p.m., also Thursdays if enrollment warrants. This is a complete course in which the student produces his own telescope mirror which becomes his property; he is also instructed in the design and construction of telescope mountings; there is a special fee for materials and instruction.

TRANSFER CHATTANOOGA OBSERVATORY

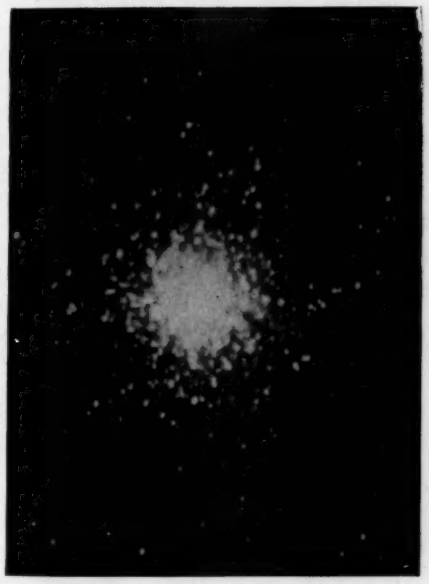
A note from Clarence T. Jones, of the Barnard Astronomical Society, reports that the Chattanooga Observatory (see The SKY, July, 1939) has been given, by the city, to the University of Chattanooga. Due to current conditions, the observatory has been closed this last year, but will now be open to the public at least one night a week.

BEGINNER'S PAGE

Man and His Expanding Universe — XI

By Percy W. Witherell

CHARLES MESSIER (1730-1817), in searching for comets, found that some of the hazy objects in the sky did not change their positions in relation to their neighboring stars and so were not comets. To eliminate the work of repeating observations on objects which he had previously determined were not comets, he had recorded these starless nebulosities (*nébuleuse sans étoiles*) in his now famous catalogue. The objects in this catalogue are commonly designated by the letter M followed by a number, there being 103 in all. This list, made over 160 years ago, has since been classified as containing 30 open clusters, 27 globular clusters, four planetary nebulae, seven diffuse nebulae, 33 galaxies, and two unconfirmed objects, either comets or stars mistaken for nebulae by Messier. His small telescope was unable to show



The globular cluster, M13, in Hercules, as photographed by Claude Carpenter, an amateur astronomer in Wayne, Mich.

any individual stars even in the mighty Hercules globular cluster, M13.

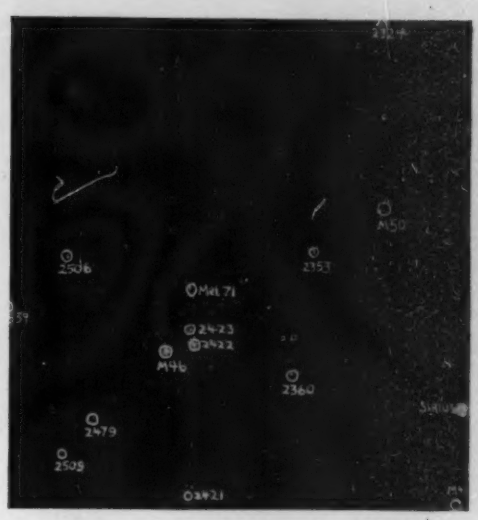
Photographic plates taken by modern telescopes have shown the number of stars in M13 that are bright enough to be recorded on the plates to exceed 60,000, and it is estimated that there are probably over 100,000 stars in the cluster. The photographs of the surrounding background of the sky record many faint galaxies, which shows that this region is not obscured by dust clouds and we can rely on the apparent luminosity of the stars in this cluster in determining its distance and its actual dimensions.

Fortunately, there are Cepheid variables in M13. The period of the variation of a Cepheid tells us its absolute magnitude. This has been proven by thousands of observations of Cepheids in such remote objects as the Magellanic clouds. If we know the absolute magnitude of a star it is easy to compute its distance, using also its apparent magnitude. The distance of the Hercules cluster is found to be about 36,000 light-years, and its diameter is about 320 light-years, including the fainter, less dense outlying portions. A count of the number of stars of different magnitudes per unit area that can be resolved in the outer regions of the cluster, combined with study of the apparent density of the unresolved stars in the central portion, makes possible the above estimates of the total population. M13 is similar in size and star density to most other globular clusters. The "Giant of Palomar" may help resolve the central mass of this beautiful naked-eye cluster and give us a better knowledge of its true structure.

In Canes Venatici is M3, whose 200 cluster-type Cepheids, with periods of less than a day, have been used to establish standards for measuring distances to other clusters, as noted above. Messier 4, in Scorpius, may be the nearest globular cluster, but it is obscured by intervening dust clouds and is not conspicuous. The southern regions of the sky are favored with 47 Tucanae, a giant globular cluster appearing near the Small Magellanic Cloud but not physically associated with it. There is also the famous Omega Centauri, 21,000 light-years distant, and in Sagittarius is M22, a bright object near the Milky Way center.

Globular clusters are located north and south of the plane of the Milky Way, to about 50° north and south galactic latitudes, and while they are more strongly concentrated near the central plane, they avoid completely the galactic equator. This peculiar distribution may be accounted for by the absorption by dark matter in the galactic plane, for the center of the system of globular clusters is near galactic longitude 327°, latitude 0°. This is close to the meeting place of Scorpius, Ophiuchus, and Sagittarius, where the star clouds of the Milky Way are brightest.

A quarter of a century ago, Harlow Shapley proposed that the spatial arrangement of the 93 globular clusters



This region in Canis Major and Puppis is notable for its clusters, many of which were catalogued by Messier.

then known indicated the central point around which our galaxy of stars, dust, nebulae and clusters, is also arranged. As the globulars are found mostly in the half of the sky centered on Sagittarius, it was apparent that our sun was rather remote from the galactic center, as described in last month's discussion. Other methods of investigation have amply confirmed the original assumption, and the globular clusters are found to form a kind of spherical framework for the more flattened system of stars.

Thus has man realized the immense size of his own galaxy. But one should not be too puffed up with its importance, for "pride goeth before a fall," and a humble spirit will be in order when we consider our neighboring galaxies.

The distribution of the globular clusters. One third of all globulars are here shown, centering on the Milky Way in Sagittarius.

SKIES OF

By Marian L

Cooler and clearer skies beckon the amat evenings. Cassiopeia and Perseus, triple host of autumn constellations described h this month. See the back cover for a jet

Come forth into the light of things,
Let Nature be your teacher.

IT IS a natural thing to concentrate mainly on the same familiar star groups as they return to the evening sky autumn after autumn, for they are old friends and we are glad to see them. But the real fun of stargazing comes from ferreting out new stellar objects, learning the outlines of new constellations, the positions of new clusters. There are many constellations which any amateur astronomer knows well, and which are the hallmark, so to speak, of a given season. Other constellations, which are not so well known, become to the astronomical epicure the most exciting part of the celestial feast.

So at this time of the year, while we shall not ignore such favorites as Pegasus and Andromeda, Cassiopeia and Aries, we shall also look for less well-known constellations.

To begin with a familiar group, let us look toward the north where high in the sky above Polaris we shall find a group of stars shaped like a W or, as you see it in mid-autumn high above you, more like the letter M. This is Cassiopeia, one of the most ancient of the constellations, dating back probably as far as 3500 B.C., and one of the best known of all the star groups. This particular constellation has for many centuries been associated with a chair or a throne. Spenser, in his *Faerie Queene*, referred to it as "the shinie Casseiopeia's chair." The chair is not complete, but is easily seen by an imaginative eye. The stars Beta, Alpha, and Gamma mark the back and Delta and Epsilon one of the front legs of the chair. In this is imagined reclining the figure of the Queen Cassiopeia. The Romans, the Arabs, and the Greeks all referred to this group of stars as a chair.

Cassiopeia can be easily found by extending through Polaris a line from Mizar in the Big Dipper; carry this line about as far again beyond the pole star. In latitudes above 40° north, Cassiopeia is a circumpolar constellation.

Cassiopeia is a "historic" constellation, considered astronomically. It was here, in the year 1572, that the famous nova known as Tycho's star appeared, right ascension $0^h\ 22^m$ and declination $+63°\ 53'$, according to Tycho's own figures. By drawing a straight line from Gamma through Kappa and continuing about half as far again, the location of Tycho's star can be approximated. Discovered by Schuler in Wittenberg in August, this nova was first seen by Tycho Brahe on November 11, 1572; it gradually became bright enough to outshine Venus, and was observed in the daytime sky. It is called Tycho's star because the great Danish astronomer paid very special attention to it. From his account we know that this star began to fade near the end of November and that by March, 1574, it had ceased to be visible to the naked eye. There are two faint stars which can be observed today near the position Tycho gave for the nova, but since his determinations of position were necessarily rough, we do not know which of the two was the famous exploding star. There is a story to the effect that the appearance of this bright star suggested to Tycho the need for a new star catalogue and stimulated his interest in such a project. A nova which appeared some 17 centuries previous may likewise have been the incentive for the famous catalogue compiled by Hipparchus.

The alpha of Cassiopeia is known as Schedar and is found in the preceding or leading half of the figure at the base of the W. This star culminates or comes to the meridian at about 11 p.m. the middle of October.

The most westerly bright star of this group is Caph, located at the point of the W toward the star Deneb. Caph leads the other stars of the constellation in their revolution around the north celestial pole. Caph, or Beta Cassiopeiae, nearly marks with Alpha Andromedae and Gamma Pegasi part of the equinoctial colure, the great circle which passes through the vernal and autumnal equinoxes and the celestial poles. The navigator, as well as the amateur astronomer, may remember that Caph is on the same side of the north pole as Polaris, and therefore is a convenient marker of the position of the pole star in relation to the pole. Caph may be used also as an indicator of sidereal time. When Caph is on the meridian above the pole, that is, higher than Polaris, it is $0^h\ 6^m$ sidereal time. When Caph is due west of the pole, it is about 6^h sidereal time; when south and closest to the horizon, it is just past 12^h sidereal time; and when due east, about 18^h. It is sometimes easier to follow the positions of Caph if you think of a line drawn from Polaris to Caph and imagine that line as the hour hand of a clock with the pole as the center of the clock face. The northern stars move around the pole, however, in a counterclockwise direction.

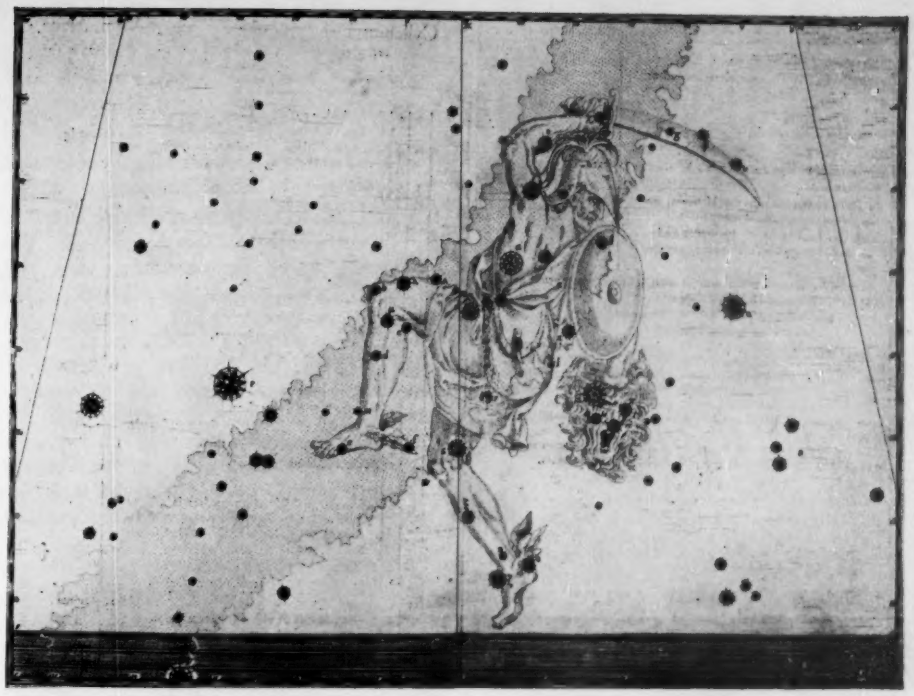
Cepheus, who in the legends is the consort of Cassiopeia, is found very close to her constellation, although the Cepheus group is not as commonly known. To find Alpha, Alderamin, draw a line from Schedar (Alpha Cassiopeiae) to Caph, and about 18 degrees farther you will find this star.

Cassiopeia's W contains five stars which photograph differently because of their colors. Gamma, in the center of the W, is blue-white and appears brightest here; Caph, at the right, is yellowish; Schedar appears faintest of the five because it is an orange star.

F AUTUMN

ARIA LOCKWOOD

the amateur stargazer these lengthening fall
us, resplendent in the Milky Way, lead the
escribed here and in the Hayden Planetarium
for a jewel of Southern Hemisphere skies.



Perseus, as he appears in Bayer's "Uranometria." Stars in Andromeda, at the right, and in Auriga, at the left, are also included.

The general shape of Cepheus is that of a distorted square topped by an isosceles triangle, the whole somewhat resembling a little house, the top of the house being Gamma Cephei, nearly on a line between Caph and Polaris.

Cepheus is an interesting constellation for the amateur to know because Delta Cephei is the type star of the Cepheid variables. These stars have turned out to be our best measuring rods for estimating the distances of remote objects such as globular clusters, the Magellanic Clouds, and the nearer galaxies, thus giving us a better idea of the scale of the universe which comes within our observation. This class of variable stars is said to pulsate. Delta Cephei at maximum has a magnitude of 3.6 and at minimum 4.3, with a period of 5.37 days. This is such a great change over such a short time that the difference can be easily detected by the naked eye. The value of these stars as measuring rods lies in what is known as the period-luminosity relationship, discovered in 1912 at Harvard by Miss Henrietta Leavitt. The absolute magnitude of this type of star is indicated by its period of fluctuation, the longer the period the greater the real brightness of the star. By comparing the absolute magnitude with the apparent magnitude, the distance of the star can be determined. Therefore, when we find such stars in abundance in clusters and galaxies and in other regions of the sky, we have good measuring rods for the distances of these objects.

Pegasus, the Winged Horse, is a constellation which is prominent and beautiful at this time of the year. Part of it forms an almost perfect square, its eastern side nearly coinciding with the equinoctial colure. Three of the stars which form the Great Square belong actually to the constellation Pegasus itself, but the fourth, which marks the northeast corner of the square, is Alpheratz, Alpha Andromedae. The constellation represents the forepart of a flying horse, peculiarly enough flying upside down through the sky. The nose of the horse terminates at the star Epsilon, Enif, a word which in Arabic means "nose." The small constellation, Equuleus, the Little Horse, can be found just west of Enif. Alpha Equulei is a 4th-magnitude star which forms an isosceles triangle with Enif (apex) and Theta Pegasi.

Andromeda is prominently marked by three bright stars stretching eastward from Alpheratz in an almost straight line; two of these stars, like Alpheratz, are of the 2nd magnitude, and one, Delta Andromedae, is 3rd magnitude.

Just above Beta Andromedae is a faint elongated patch of light. This is the Great Nebula in Andromeda, which is actually not a nebula at all but a galaxy very much like the Milky Way in which we live. The Great Nebula is a cookie-shaped mass of billions of stars, turning like a gigantic pinwheel in the sky. When we look at it we are seeing far into the past, for the light which brings its image to us started from this great system of stars about 750,000 years ago, and has taken all that time to cross the vast distance between the Great Nebula and the earth. The Andromeda spiral is the most remote object visible to the naked eye. It is intriguing to consider that possibly some of the most distant objects we observe at the present time may not be still in existence.

Just below the easternmost part of Andromeda, south of and between Gamma and Beta, lies the constellation Triangulum. This group of stars forms an isosceles triangle lying on its side, between Andromeda and Aries. On January 1, 1800, the Italian astronomer Piazzi discovered the asteroid Ceres in this part of the sky. This was an occasion of note, for Ceres was the first asteroid to be discovered. The astronomically minded poet Aratos referred to Triangulum in this way:

Beneath Andromeda, three lines compose
The Triangle. On two sides measured equal,
The Third side less.

Perseus can be found, a beautiful necklace of stars, hanging from Ruchbah (Delta Cassiopeiae) to the Pleiades. Alpha Persei, known as Marfak, is found by a line drawn from Beta Andromedae through Gamma Andromedae and continued about nine degrees beyond Gamma.

In Perseus is a naked-eye object of great interest—the variable star Beta Persei, or Algol. This star is an eclipsing binary varying in magnitude from 2.3 to 3.5. For about two days and 11 hours its magnitude remains at approximately 2.3, and then in five hours falls to 3.5. In another five hours, the star has regained its original brilliance. Algol is an Arabic word, meaning "the Demon," which would seem to indicate that the Arabs recognized the star's variability. Algol, like all other stars of the eclipsing type, behaves as it does because it is composed of two stars which eclipse

(Continued on page 15)

BOOKS AND THE SKY

LIFE ON MARS

Donald Lee Cyr. Desert Magazine Press, El Centro, Cal., 1944. 50 pages. $1.00.

BEGINNING with a discussion of craters on the earth and on the moon, Mr. Cyr demonstrates that the Martian oases, those round dark spots at the intersections of "canals," are really meteoric pits. Because they can hold moisture on the desert surface of the planet, these craters harbor vegetation in the midst of otherwise arid regions. The Martians, he maintains, naturally took advantage of these oases and dug canals connecting them, so as to utilize their precious water supply most efficiently.

The author points out that the rugged conditions of life on Mars must surely have produced a hardy race of pioneers. The subordination of one network to another, the existence of double canals, and the haphazard disposition of waterways over the planet reveal the details of the Martians' economy, as well as the history of their engineering projects.

Mr. Cyr is indeed a remarkable man to start with a few oases, indistinctly seen, and a network of canals, whose existence has never been definitely established, and to arrive at a whole civilization, complete with an elaborate economy, an advanced agriculture, an efficient transportation system, and a highly organized co-operative society!

I shall not point out the inaccuracies in the author's data inasmuch as the entire discussion of the origin of the oases is irrelevant to the problem of life on Mars. Whether the pits occurred naturally and the Martians merely connected them, or whether the canals were dug first and the oases later constructed at their junctions, is of comparatively little importance. The chief issue which must be settled is whether or not the markings on the planet are thin straight lines, occurring both singly and in pairs, and grouped into elaborate networks; for upon this issue turns the enigma of intelligent life on Mars.

EDWARD B. BURKE
Harvard University, '46

ELECTRONIC PHYSICS

L. Grant Hector, Herbert S. Lein, and **Clifford E. Scouten.** The Blakiston Company, Philadelphia, 1943. 355 pages. $3.75.

THIS text, designed to meet the need for instruction in the subject of electronic physics demanded by the war effort, is, as the authors state in the preface, "written for beginners. Its style is based on the assumption that its readers are beginners but beginners capable of being interested in the way in which nature behaves."

The topics covered range from the characteristics of electricity to the transmutation of the elements. Treatment of these topics is almost wholly qualitative; the few mathematical equations developed or quoted will be easily understood by anyone having a knowledge of elementary algebra. The explanations of the phenomena discussed are made from the modern electron-proton point of view; the electrical nature of the atom is constantly stressed.

Titles of selected chapters will serve as an index to the types of subjects treated: "The Discovery and Nature of Electricity," "Electric Power and Energy," "Batteries," "Induced Electric Currents," "Inductance and Alternating Currents," "Wireless," "Electron Tubes." There are also chapters showing the relationship between electricity, light, and X-rays. Several chapters deal with geometrical optics — the geometrical theory of the refraction of light by lenses and prisms, and the reflection of light by mirrors—and photometry. These latter subjects are ordinarily not covered in books on electronic physics.

Noteworthy features of the book are: 1. The short overviews of what is to be considered which preface each chapter. 2. The sections at the end of each chapter which review the most important facts covered, and give a central thought summarizing the material of the chapter. 3. Problems, which are given in graded groups, one for all stu-

dents, and a second group for more advanced students. 4. Outlines of experiments designed to illustrate important points, and which may be performed in the home or in the laboratory. 5. The numerous line drawings which are reproduced in two colors, a feature greatly increasing their clarity.

The book may be recommended to anyone interested in an elementary explanation of the fundamentals of the important branch of physical science designated in the title.

HAROLD F. WEAVER

FORWARD WITH SCIENCE

Rogers D. Rusk. Alfred A. Knopf, New York, 1943. 307 pages. $3.50.

FORWARD WITH SCIENCE is a kaleidoscopic picture of developments in modern science, carefully interpreted for the layman. From atoms to nebulae, from harnessing atomic energy to cosmic rays, Prof. Rusk has made the developments in the physical sciences meaningful and understandable.

This is a refreshing book on science. It does not rely on the reader's previous knowledge. Typical is the chapter on the electron microscope, which outlines the early attempts to extend man's vision, the limitations of the ordinary microscope, how the electron microscope works, its relation to television, and its applications in science and industry.

Other chapters deal, in a similar manner, with the Wilson cloud chamber, X-rays, high-speed photography, atom smashing, cosmic rays, astrophysics, science and the soldier, and not the least —our own good earth.

Forward With Science offers the layman an excellent overall picture of scientific discovery and theory, and the part science will play when men can once again turn to developing its potentialities to aid man and not for his destruction.

R. NEWTON MAYALL
American Association of
Scientific Workers

The INDEX for Volume III

is in preparation. It will be similar to previous indexes, including title page, author, title, subject, and topic references. Inclusion of the whole number of each issue on each page of Volume III will facilitate use of this index. It is invaluable for quick reference and for best use of the volume. Send 25 cents, and your copy will be mailed as soon as printing is completed.

The Indexes for Volume I and Volume II are still available. Cost of these is 25 cents each.

Sky Publishing Corporation
Harvard College Observatory
Cambridge 38, Mass.

SKIES OF AUTUMN

(Continued from page 13)

each other as they revolve around their common center of gravity.

The Double Cluster in Perseus is of great interest, and can be found near the top of the long curve of Perseus. This object is visible to the naked eye, and is well worth examining with opera glasses or binoculars.

Under the Great Square of Pegasus lies a faint circle of stars known as the Circlet or the Western Fish. This is part of the ancient zodiacal constellation Pisces, the Fishes, which takes roughly the form of two circles joined by a long V-shaped group of stars. All the stars in this constellation are faint, none brighter than 4th magnitude. The March equinox (first point of Aries), moved to the westward out of Aries by the precession of the equinoxes through many centuries, is found just east of the Circlet.

A line drawn through the western side of the Great Square, that is, through Beta and Alpha Pegasi, brings the observer's eye to the faint but beautiful constellation of Aquarius, the Water Carrier. Here there is a spate of faint stars clustered in twos and threes and fours. The effect is almost magical although there is not a bright star among them. Below Aquarius is the bright star Fomalhaut in the constellation Piscis Austrinus. In the latitude of New York, Fomalhaut rises about 20 degrees above the southern horizon.

Capricornus is a group of stars shaped like an inverted tricorne south of the westernmost part of Aquarius and to the east of Sagittarius. The planet Neptune was discovered in Capricornus in 1846.

All of the objects discussed in this article are visible with the naked eye but many of them are more exciting when viewed through opera glasses or binoculars, to say nothing of telescopes. While there is space here to mention only some of the most interesting celestial objects in the autumn sky, there are many books available which will lead the amateur onward through the reaches of the heavens, opening boundary after boundary of beauty and space.

NEW BOOKS RECEIVED

THINGS THAT FALL FROM THE SKY, *Roy K. Marshall*, 1944, *The Franklin Institute*. 16 pages. 15 cents.

An illustrated pamphlet on meteors and meteorites, which includes discussion of the paths of meteors, showers, the connection between comets and meteors, fireballs, and meteorite craters. It contains a list of the world's largest meteorites.

SKY-GAZERS EXCHANGE

Classified advertisements are accepted for this column at 30c a line per insertion, 7 words to the line. Minimum ad 3 lines. Remittance must accompany orders. Address Ad Dept., Sky and Telescope, Harvard College Observatory, Cambridge 38, Mass.

WANTED: 3" achromatic objective lens, approximately 75" f.l., good condition. Will pay any reasonable price. Write James Bray, 860 Walnut Ave., Burlingame, Cal.

FOR SALE: Telescope, 2" achromatic, 3 oculars, 30 to 120 power. Diagonal; finder; tripod. Beauty. $168.00. H. Weisenberger, 2549 Endicott, Overland 14, Mo.

WANTED: Stationary mounting (with circles) for 3" telescope adaptable for any latitude. Write to Hobby Abshier, 609 W. Commercial St., Victoria, Tex., giving details and price.

GLEANINGS FOR A.T.M.s

Testing the Focal Lengths of Telescopic Oculars

THE rated focal length* of an eyepiece is usually accepted as correct by a telescope user. I have recently tested the equivalent focal lengths (e.f.l.) of 35 oculars, the products of eight manufacturers, and find that although most of the intermediate powers are usually correctly rated, large errors often occur in the low and high powers. The ratings of some companies are consistently accurate, while those of others are decidedly not.

Two methods for testing will be described. Let us start with the familiar optical formulas: $F/f = m$; $1/D_o + 1/D_i = 1/F$; and $H_o/H_i = D_o/D_i$. F and f are the focal lengths of the objective and eyepiece respectively; m, the magnification; D_o and D_i, the distances of the object and image from the lens; H_o and H_i, the heights (or widths) of the object and image.

The first formula above is correct only when the object is very distant. The magnification increases greatly as the object is brought near the telescope. In one of my tests, m was 11.4 when D_o was 33 feet and 18.5 when D_o was decreased to a few feet. From the formulas above, it can readily be shown that H_i becomes relatively larger as D_o is decreased. Besides, when the object is fairly near, the difference in distances from the eye to the object and the objective lens to the object can no longer be considered as equal without introducing considerable error. Tests may be made with the object quite near (I used only 20 feet), but to avoid corrections let us assume that it is sufficiently distant that we may consider $D_i = F$ without serious error. Thus, if F is about one foot, D_o may be only 100 feet without much error; a telescope finder is a good test instrument.

F was determined by directing the telescope at a sunlit hill seven miles away, removing the eyepiece, placing a piece of thin, oiled paper against the eye end of the tube, and focusing until the transmitted image was sharp. F could also have been found by using a well-lighted nearby object and applying the second formula above.

A meter stick subdivided into centimeters and tenths was used as a target. Any convenient distance may be taken. This stick was hung in a vertical position and viewed through the telescope with one eye and along the outside of the tube with the other. A slight squinting of one of the eyes is sometimes necessary in order to see both the magnified and unmagnified markings clearly.† The purpose is to note how much of the stick as seen magnified is needed to extend the entire 100 centimeters of the object seen without magnification. Suppose 21.3 cm. touches the top of the stick and 11.1 cm. the lower end. This means that 10.2 cm. magnified equal 100 cm. unmagnified, or a magnification of 100/10.2, or 9.8x. If the testing telescope has F = 15 in., then application of $F/f = m$ gives $f = 15/9.8 = 1.53$ in. If the ocular is marked "1½ in." the rating is highly satisfactory. But if the test should give 1.19, you may assume the manufacturer is careless with his figures. Any graduated scale will serve as a target; in fact, if only approximate results are required, any object which has equal divisions may be used, such as a brick wall or a picket fence. The number of bricks or pickets in the direct image contained in one brick or picket in the telescope image is the magnification.

The second method (except for initial focusing) requires no sighting at distant objects, but does necessitate the very careful measurement of a small image. Proceed as follows: Accurately focus the telescope on something quite distant. Then turn it so it is directed at the bright daytime sky. If the eye is then placed about a foot behind the eyepiece, a distinct but small image of the objective lens will be seen suspended in the air a very short distance behind the opening in this ocular. This is the exit pupil, and is the image cast by the eyepiece with the objective lens acting as the object. It is really quite uncanny looking, almost ghostly. Often this image is seen better if the cap of the ocular is unscrewed and removed. As part of the inside of the tube near the objective is usually included in this image, the whole often has the appearance of a short, misty tube of light extending back from the eyepiece opening.

The magnification of a telescope is given by the formula: m = entrance pupil/exit pupil. The clear aperture of the objective constitutes the entrance pupil. The exit pupil is best examined by using a hand lens on it. It may then be measured by placing a transparent metric ruler against it. Or the image may be received on a piece of thin, oiled paper and then measured after transmission through the thickness of the paper. For the most accurate work, it is suggested that both the paper and ruler be held in some support and then examined with the hand lens. Estimates to tenths of millimeters should be made. With F and m now known, f may be found from $F/f = m$.

*Eyepieces are sometimes rated by "power." To convert to equivalent focal length, we can use the expression, $P = 10/f$ inches, or $25/f$ centimeters. Thus, an eyepiece marked 25x has an e.f.l. of 0.4 in. or 1 cm.

†This trick is difficult at first, but becomes relatively easy with a little practice. The separate images seen by the two eyes can be superimposed, as in ordinary binocular vision. "Squinting" reduces the light entering the eye and offsets a natural tendency of one of the eyes to predominate to the extent that the image formed by the other eye is rejected by the brain. The magnified image seen through the telescope will tend to predominate. ED.

EDITED BY EARLE B. BROWN

Consider a test with a 4-inch (10.16 cm.) objective (F = 60 in.) and a 1½-inch ocular. Assume the exit pupil has a diameter of 0.25 cm. This gives the magnification 10.16/0.25, or 40.6x. From F/f = m, we get f = 1.46.

One must be sure that the entire exit pupil is obtained. Removing the ocular cap often helps. If there are diaphragms inside the telescope tube, be sure they are not interfering. Careful examination of the image with the hand lens, together with a movement of the head back and forth, will usually give this information. If there is any uncertainty, place over the objective a piece of cardboard in which a large, square hole has been cut. The image will then be square and it will easily be seen whether the corners are cut off.

Below are given the results of some of my tests. The letters A, B, C, etc., indicate respective manufacturers' products without mentioning names. Without fear of reprisals, it may safely be said that E is a Zeiss 9 mm. orthoscopic and F is Leo Scanlon's "Black Beauty." Two of the sets tested had no designated ratings, so cannot be compared. The columns headed R give the makers' ratings of their products in inches of e.f.l.; T, the values obtained from my tests.

R	T	R	T
A		C	
2.00	1.91	2.00	2.18
1.33	1.17	1.50	1.17
1.00	1.02	1.00	0.87
0.75	0.75	0.75	0.55
0.50	0.52	0.33	0.32
0.33	0.40	0.25	0.22
0.20	0.28	D	
B		1.00	1.17
1.50	1.36	1.25	1.21
1.00	0.98		
1.00	0.97	E	
1.00	0.99	0.35	0.35
0.50	0.47	F	
0.31	0.30	1.13	1.13

J. HUGH PRUETT
University of Oregon, Eugene, Ore.

Mr. Pruett added a mathematical proof of the equation, entrance pupil ÷ exit pupil = m, or $H_O/H_i = m$. Since this constitutes a **definition** of magnification of a telescope, we have omitted this proof. A note of caution should be inserted here to the effect that **the telescope must be accurately focused for infinity** before the measurement is made. It is best not to depend upon the eye for setting the eyepiece on a distant object. Any ammetropia of the observer's eye will affect the setting, and there are psychological factors which are even more effective in producing errors of adjustment. Place any small telescope behind the eyepiece of the telescope under test and adjust the eyepiece of the latter until a distant object is clearly in focus as seen through both telescopes. The small testing telescope should have previously been focused on a distant object, but minor errors of setting are unimportant. Half of a binocular is excellent to use. Be sure the only light entering its objective is from the eyepiece of the telescope under test. ED.

NEWS NOTES

(Continued from page 8)

"line" in the spectrum of a rotating star is widened according to the star's speed of rotation. But if the temperature or density of the star is not the same over its entire observable surface, the broadened spectral lines will reveal such variations.

The orbit of U Cephei has presented one of astronomy's great paradoxes. Visually the star had been so well observed that the orbit determined from photometric data could hardly be questioned. On the other hand, a spectroscopic orbit determined by Dr. E. F. Carpenter, of Steward Observatory, from Lick spectra in 1930, gave quite discordant results. If the spectroscopic orbit was not to be trusted, one might reasonably be skeptical about many other spectroscopic orbits for stars for which photometric orbits could not be obtained. Dr. Carpenter's orbit had not been redetermined elsewhere until Dr. Struve recently obtained an excellent series of spectrograms of U Cephei with the 82-inch McDonald telescope. Analyzed by the usual procedures, these spectra did indicate an orbit similar to Dr. Carpenter's, in that the curve showing the change of radial velocity throughout a light cycle was asymmetric—a non-circular orbit was indicated.

Modern analysis has helped in the interpretation of these observations. During the partial phases of the eclipse, Dr. Struve found the hydrogen lines very unsymmetrical, showing narrow cores toward the violet of their centers before totality, but with stronger, broader cores toward the red after total eclipse. This peculiar behavior the Yerkes astronomer interprets provisionally as due to low-pressure streams of gas flowing from one star to the other in a manner similar to Beta Lyrae. Currents which distort spectral lines during the partial phases might do so outside eclipse. This would make the radial velocity (spectroscopic) curves unsymmetric, spuriously leading to the interpretation of highly eccentric orbits.

Observational data were not available to test this theory completely for U Cephei, but they were available for SX Cassiopeiae. Its spectrum shows double emission lines which indicate that there are two streams of matter which flow from the cool, large, dim star along the following side of the hot, small component; the streams then return along its preceding side after making a complete circuit. These streams account well for the distortion of the spectral lines which appear to indicate high orbital eccentricity.

As a by-product of his investigation, Dr. Struve has found that in the case of U Cephei the small, hot star has an extremely rapid rotation, some 100 times faster than the velocity on the surface of the sun. The secondary, larger component rotates much more leisurely. The light curve indicates that the hot star is about half as large as the cooler one and that their surfaces are separated by a distance less than the radius of the larger star. In such close systems, it is expected and usually observed that the periods of rotation and revolution are the same, the stars always presenting the same sides to each other. Here, then, is another strange characteristic of U Cephei.

OBSERVER'S PAGE

All times mentioned on the Observer's Page are Eastern war time.

A Double Meteor Among the Perseids

MANY reports of successful observations of the Perseid meteors have been received. Everett A. Marsh, of Monkton, Md., writes:

"On the night of August 9th at 10:56 E.W.T., a very interesting and unique double meteor was observed in the constellation Camelopardalis, just about 11 degrees under the pole star and traveling in an east-to-west direction at relatively high velocity. The two meteors were about 4 degrees apart and (as near as could be observed) parallel to each other and horizontal to the northern horizon.

"Both meteors appeared to enter the atmosphere at exactly the same time and the durations (estimated at 1½ seconds) were identical. Both were of about the 1st magnitude. The color began as a deep yellow to red and faded to a light yellow. The brightest point was about 2/3 of the duration time. No trains were observed without optical aid. The observations were made at Hereford, Md. The meteors were probably of the Perseid swarm. If any other reports come in regarding these meteors, I should very much appreciate knowing of them."

A chart of the path of this double meteor was sent in by Mr. Marsh and will be forwarded to the American Meteor Society. Dr. Charles P. Olivier states through Science Service that the best record for the Perseid shower was received from Shawnee, Okla., where Lt. R. J. Wood, U.S.N.R., organized an observing group whose members counted 1,250 meteors in four nights of watching. Among the meteors observed were several fireballs of great brilliance.

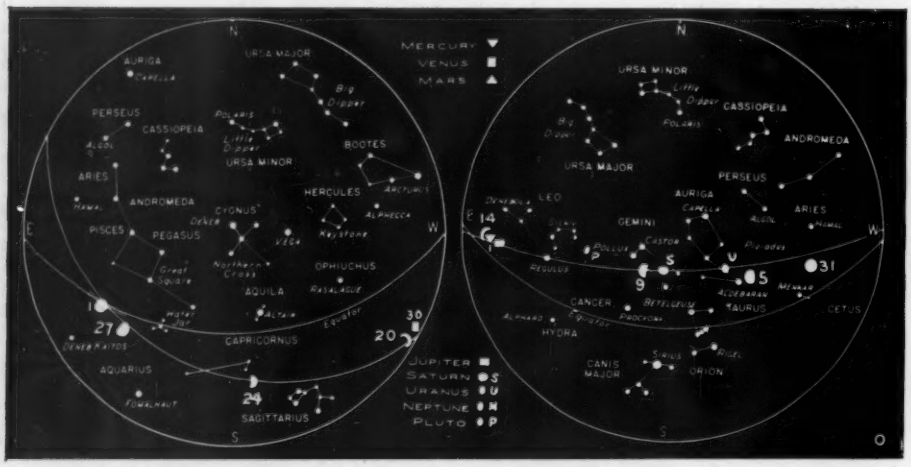
A detailed report of six nights of Perseid observing has been received at Harvard Observatory from Wilmond W. Parker, of Bethel, Vt. In his summary of 91 Perseids observed on August 9-10-11, this amateur reports one to have been of magnitude —3, two of magnitude —1. Distinct trails were shown by 37 of the meteors. On the evening of August 11th, Mr. Parker observed 77 meteors, of which he estimated some eight to be non-Perseids.

He writes, in part: "Location: Bethel, Vt., in village; open field, somewhat away from street lights. Lay flat on my back and observed the area which could be seen without turning my head. Estimate that I commanded an adequate view of everything within 45° of the zenith . . . . Throughout I was bothered in distinguishing faint meteors from imagination or faulty vision . . . . Feel sure that some, at least, of the faint glimpses are really meteors, and not imagination; however, did not count them.

"August 11: total observing time, 130 minutes, in two sessions. From 9:20 to 10:08 had 'assistance' of my two daughters, 9 and 4, whose eyes were sharp, but whose conversation was distracting. They did give confirmation to a number of brief, faint meteors which I should have ignored as figments of the imagination . . . . 10:38-12:00, saw 48 Perseids and six non-Perseids, working alone.

"August 12: Mosquitoes thicker than meteors, so made no magnitude estimates, and didn't linger long."

THE MOON AND PLANETS IN THE EVENING AND MORNING SKIES



In mid-northern latitudes, the sky appears as at the right at 6:30 a.m. on the 7th of the month, and at 5:30 a.m. on the 23rd. At the left is the sky for 8:30 p.m. on the 7th and for 7:30 p.m. on the 23rd. The moon's position is given for certain dates by symbols which show roughly its phase. Each planet has a special symbol, and is located for the middle of the month, unless otherwise marked. The sun is not shown, although at times it may be above the indicated horizon. Only the brightest stars are included, and the more conspicuous constellations.

Mercury may be seen shortly before sunrise at the beginning of the month.

Venus, in the evening sky not far from the sun, moves in Virgo, Libra, Scorpius, and Ophiuchus. It is 35′ south of Alpha Librae on the 9th, and 2° south of Beta Scorpii on the 24th.

Mars is too near the sun to be seen.

Jupiter is in Leo, and becomes better placed in the morning sky as the month progresses.

Saturn, in Gemini, will start retrograde motion on the 23rd.

Uranus is in Taurus.

Neptune is close to the sun.

Pluto is in Cancer.

By Jesse A. Fitzpatrick

MERCURY OCCULTED

CHRISTIAN BASHORE, of Bradford, Ohio, and Frederic Oheim, of New Braunfels, Tex., independently report observations of the occultation of Mercury on July 21st. As far east as New York, the immersion and moonset must have occurred at nearly the same minute, while in the Far West daylight would have been too strong to see either the moon or the planet. Because of the various unfavorable factors always attending an occultation of Mercury, the **Ephemeris** never gives the elements for the prediction of such an event. A rough approximation checks the times given by both observers, portions of whose letters follow.

Mr. Bashore writes: "On July 21st, just after sunset, I observed a 'star' about to be occulted by the day-old moon. Occultation took place at about 8:30 C.W.T. Consulting the Graphic Time Table in the January **Sky and Telescope**, I concluded that the body must be the planet Mercury. According to the table, Mercury would not reach eastern elongation until August 10th. I had no idea it could be seen so long before that date, considering the inclination of the ecliptic at this time of year. My local position, as nearly as I can determine from maps, is about 40° 8′.1 N., 84° 28′.6 W."

From Mr. Oheim, we hear: "It is interesting to observe the 'shadow of the world' creeping up the well of haze in the east as the sun sets. A friend of mine who spent most of his youth in northern states tells me that this phenomenon is much more pronounced in Texas than it is farther north.

"I had the opportunity to observe my first planetary occultation last month on the 21st of July when the moon occulted Mercury at 8:58:28 C.W.T. Previous occultations of Jupiter and Venus since I have been observing have been

rained out here. Due to the nearness of the moon and Mercury to the horizon, conditions were very poor, but I was able to time the disappearance of the planet behind the disk of the moon. The limb of the moon was invisible against the twilight sky, and the planet itself was hardly discernible as a disk. The image was crawling and the disturbed air made it impossible for me to even guess at the time of first contact.

"Mercury has been easily visible at this apparition to us in this latitude; my station is 29° 42′ 26″; 98° 7′ 7″."

Readers interested in these observations of Mercury may wish to review the discussion in this department in the August issue. Mr. Oheim's reference to the "shadow of the world" is to a rather common event which is often not noticed until the observer happens to watch an unhampered eastern horizon just after sunset. The arch of darkness can be seen rising higher into the eastern sky as the sun gets farther and farther below the western horizon.

OCCULTATIONS FOR TEXAS

Predictions are for longitude 98° 0′.0 W., and latitude 30° 0′.0 N. The data include: date, name of star, magnitude; G.C.T. in hours and minutes, **a** and **b** quantities in minutes, and position angle, at immersion; G.C.T., **a** and **b** quantities, and P.A., at emersion.

The predictions, computed voluntarily by Miss Tecla Combariati and J. Lynn Smith, of the U. S. Naval Observatory, are similar in form to those given in the **American Ephemeris** for 1944, pages 365-372.

Oct. 6, 302 B Tau, 6.1; 11:11.9, —2.5, —0.4, 91°; 12:35.3, —1.9, +0.5, 243°.

Oct. 6, i Tau, 5.1; 14:19.1, —0.8, —2.0, 114°; 15:17.2, —0.8, +0.2, 236°.

Oct. 7, 372 B Tau, 6.1; 5:46.3, +1.3, +4.3, 7°; 6:10.0, —2.0, —1.8, 320°.

Oct. 25, BD —21° 5729, 6.8; 3:57.5, —3.9, —5.6, 142°; . . . .

Oct. 25, BD —15° 6180, 7.1; 22:53.6, —1.3, +2.6, 32°; . . . .

Oct. 28, Psi³ Aqr, 5.2; 1:43.4, —1.9, +1.3, 67°; 3:03.4, —1.8, +1.3, 234°.

PHASES OF THE MOON

Full moon	October 2,	0:22 a.m.
Last quarter ...	October 8,	9:12 p.m.
New moon	October 17,	1:35 a.m.
First quarter ...	October 24,	6:48 p.m.
Full moon	October 31,	9:35 a.m.

MINIMA OF ALGOL

Oct. 7, 4:31 a.m.; 10, 1:19 a.m.; 12, 10:08 p.m.; 27, 6:21 a.m.; 30, 3:01 a.m.

DAYTIME FIREBALL OVER MIDDLE WEST

ON August 18th, about 8:15 a.m. C.W.T., a fireball flashed across Ohio, Indiana, and exploded over Wabash County, Ill. It left a train of 10 minutes' duration, and some observers reported it to be so bright it hurt their eyes to look at it. About 160 reports had been received at the American Meteor Society by early September, and some time must elapse before a definite path can be traced. Data are still needed from the actual area where meteorites may have reached the earth, that is, in southwest Wabash County, or somewhat farther to the southwest. Dr. Charles P. Olivier, Flower Observatory, Upper Darby, Pa., will be glad to receive reports from those who believe they can furnish definite and reliable information. Many of the reports came in response to a request released through Science Service, and some have been forwarded to Dr. Olivier by this department.

Typical of letters received is one from R. W. Noland, consulting engineer of Fort Wayne, Ind., who wrote on August 19th:

"As a matter of possible scientific interest, I am reporting that today I talked with Mrs. George Zeiler of Marion (R.F.D. 3), Ind. Mrs. Zeiler was one of the fortunate persons who observed the daytime meteor which was reported as passing over southern Indiana at approximately 8:20 a.m. on August 18th.

"Mrs. Zeiler is one of those persons who can give an accurate description of what she sees. The Zeiler home is located in the country five miles due south of downtown Marion on Indiana highway No. 9; she was standing in her front yard and was looking directly south down the highway. The meteor path was approximately two or three degrees above the southern horizon, in fact it was so low that it was visible to her only as it crossed the opening in the trees made by the highway. She describes it as appearing as a silver sword and says that it was one of the most beautiful and awe-inspiring sights she had ever witnessed. Her impression is that it was very near. A sketch was made by me while standing at the exact point on the lawn from which she observed the phenomenon.

"While I do not class myself as an astronomer in any sense of the word, I have always been intensely interested in everything astronomical and have even had the audacity a few times to give a talk before various groups on what I have called 'Our Amazing Universe.' I suspect that I have been able to get away with this talk in fairly good style because my audience knew even less than I did about the subject."

And from New Rumley, Ohio, Clifford Albaugh writes:

"On Friday morning, August 18th, at around nine o'clock, quite a few people in this neighborhood were greatly startled by a meteor which was several times brighter than the sun. It was so luminous that it was quickly noticed in full sunlight. I have had many conflicting details concerning this meteor; its direction of motion was probably from southeast to northwest; it left an extremely luminous train of light behind and it was traveling at a high speed.

"I was working in the pottery at Scio (Harrison County) when this occurred. Some of the employees who were working outside the building were talking about it at noon and I tried to gather as many facts as possible, but some were not reliable enough to confirm as factual. Those that saw it said it was the most brilliant meteor they had ever beheld."

PLUTO

Harvard Announcement Card 691 states that the U. S. Nautical Almanac Office has prepared a geocentric ephemeris of Pluto, to $0^m.1$ and 1′, for the period October 29, 1944, to May 1, 1945. Capt. J. F. Hellweg, superintendent of the U. S. Naval Observatory, writes that the ephemeris will be furnished observers on request.

The most distant planet in the solar system requires clear skies and considerable light-gathering power for its observation; in addition, the setting circles should be accurate on a well-mounted telescope, or charts of the region showing stars to the 15th magnitude should be available. It is suggested that the ephemeris will prove of value only to amateurs so equipped.

OCCULTATIONS—OCTOBER, 1944

Local station, lat. 40° 48′.6 north, long. $4^h\ 55^m.8$ west.

Date	Mag.	Name	Immersion	P.*	Emersion	P.*
Oct. 7	6.1	372 B Tauri	2:12.9 a.m.	11°	2:49.0 a.m.	318°
Oct. 23	5.6	222 B Sagittarii	6:36.0 p.m.	27°	7:24.4 p.m.	321°
Oct. 26	7.1	BD —15° 6180	7:53.1 p.m.	17°		
Oct. 27	5.2	Psi³ Aquarii	10:37.6 p.m.	76°	11:47.8 p.m.	225°

*P is the position angle of the point of contact on the moon's disk measured eastward from the north point.

DEEP-SKY WONDERS

AMONG marvels for observation in the October skies are the objects listed here. The informal descriptions give appearance in common telescopes.

Hercules. M13, $16^h\ 39^m.7$, $+36°\ 34'$; popular globular. Though better advertised, M13 is smaller and dimmer than M5 in Serpens. Compare M13 with its less conspicuous neighbor, M92.

Perseus. M76, $1^h\ 39^m$, $+51°\ 18'$; planetary. Cork-shaped; miniature of Dumbbell nebula, M27, in Vulpecula. M34, $2^h\ 35^m.6$, $+42°\ 21'$; widespread cluster of 80 bright stars.

Andromeda. M31, $0^h\ 40^m$, $+41°\ 00'$; famous spiral. Most distant object visible to unaided eyes; neighbor of our own galaxy, though 750,000 light-years distant; has two small associate galaxies.

L. S. COPELAND

STARS FOR OCTOBER

from latitudes 30° to 50° north, at 10 p.m. and 9 p.m., war time, on the 7th and 23rd of the month, respectively. The 40° north horizon is a solid circle; the others are circles, too, but dashed in part. When facing north, hold "North" at the bottom, and similarly for other directions. This is a stereographic projection, in which the flattened appearance of the sky itself is closely reproduced, without distortion.

EVENING STARS FOR SOUTHERN OBSERVERS

THIS is the second map in the series of star charts for use by observers in the Southern Hemisphere, and matching the northern maps. It is prepared for a basic latitude of 30° south, but may be used conveniently 20 degrees on either side of that parallel. These southern charts appear in alternate months, but always two or three months in advance, to allow time for transmission to observers in any part of the world. When 12 charts have been produced, and if interest warrants, a special edition of **Sky and Telescope** may be published each month carrying observing material for Southern Hemisphere observers. This chart is for use in latitudes 20° to 40° south on December 7th at 11 p.m., December 23rd at 10 p.m., January 7th and 23rd at 9 p.m. and 8 p.m., respectively. Times for other days vary similarly: four minutes earlier per day. These are local mean times which must be corrected for standard time and war time differences. The 30° horizon is a solid circle; the other horizons are circles, too, those for 20° and 40° south being dashed in part. When facing south, hold "South" at the bottom, and similarly for other directions. Observers in the tropics may find north circumpolar stars on any of our northern star charts.

HERE AND THERE WITH AMATEURS

This is not intended as a complete list of societies, but rather to serve as a guide for persons near these centers, and to provide information for transplanted amateurs who may wish to visit other groups. The asterisks denote societies whose members receive *Sky and Telescope* as a privilege of membership.

City	*Organization*	*Date*	*P.M.*	*Season*	*Meeting Place*	*Communicate with*
BOSTON	*BOND AST. CLUB	1st Thu.	8:15	Oct.-June	Harvard Obs.	Homer D. Ricker, Harvard Observatory
"	A.T.M.S OF BOSTON	2nd Thu.	8:15	Sept.-June	Harvard Obs.	F. A. Pflug, 685 Centre St., Jamaica Plain
BROOKLYN, N. Y.	ASTR. DEPT., B'KLYN INST.	Rd. Table 3rd Thu.	8:15	Oct.-April	Brooklyn Inst.	William Henry, 154 Nassau St., N. Y. C., *BA.* 7-9473
BUFFALO	A.T.M.S & OBSERVERS	1st, 3rd Fri.	8:00	Oct.-June	Mus. of Science	J. J. Davis, Museum of Science
CHATTANOOGA	BARNARD A. S.	4th Fri.	7:30	All year	Chattanooga Obs.	C. T. Jones, 326 James Bldg., *CHat.* 7-1936
CHICAGO	*BURNHAM A. S.	2nd, 4th Tue.	8:00	Sept.-June	La Salle Hotel	Miss W. Sawtell, 928 N. Harvey Ave.
CINCINNATI	*CIN. A.A.	2nd Fri.	8:00	Sept.-June	Cincinnati Obs.	Dan McCarthy, 1622 DeSales Lane
CLEVELAND	CLEVELAND A. S.	Fri.	8:00	Sept.-June	Warner & Swasey Obs.	Mrs. Royce Parkin, The Cleveland Club
DAYTONA BEACH	D. B. STARGAZERS	Alt. Mon.	8:00	Nov.-June	500 S. Ridgewood Ave.	Rolland E. Stevens, 500 S. Ridgewood
DETROIT	DETROIT A. S.	2nd Sun.	3:00	Sept.-June	Wayne U., Rm. 187	E. R. Phelps, Wayne University
"	NORTHWEST A.A.S.	1st, 3rd Tue.	8:00	Sept.-June	Redford High Sch.	A. J. Walrath, 14024 Archdale Ave.
DULUTH, MINN.	DULUTH AST. CLUB	Meetings suspended				Ray S. Huey, 1822 E. 3rd St.
FT. WORTH	TEX. OBSERVERS	No regular meetings				Oscar E. Monnig, 1010 Morningside Dr.
GADSDEN, ALA.	ALA. A.A.	1st Thu.	7:30	All year	Ala. Power Audit.	Brent L. Harrell, 1176 *W* or 55
INDIANAPOLIS	INDIANA A.A.	1st Sun.	2:15	All year	Odeon Hall	E. W. Johnson, 808 Peoples Bank Bldg.
JOLIET, ILL.	JOLIET A.S.	Alt. Tue.	8:00	Oct.-May	Jol. Mus. & Art Gall'y	Mrs. Robert L. Price, 403 Second Ave.
LOS ANGELES	L.A.A.S.	2nd Thu.	8:15	———	2606 W. 8th St.	A. M. Newton, 2606 W. 8th St.
LOUISVILLE, KY.	L'VILLE A.S.	3rd Tue.	8:00	Sept.-May†	University Center, Univ. of Louisville	Mary Eberhard, 3-102 Crescent Ct. *Taylor* 4157
MADISON, WIS.	MADISON A.S.	2nd Wed.	8:00	All year	Washburn Obs.	Dr. C. M. Huffer, Washburn Obs.
MEMPHIS	A.T.M.S OF MEM.	Alt. Tue.	7:30	All year	Private houses	James Woody, 1056 Linden Ave.
MILWAUKEE	MILW. A.S.	1st Thu.	6:15	Oct.-May††	City Club	E. A. Halbach, 2971 S. 52 St.
MOLINE, ILL.	POP. AST. CLUB	Wed.†††	7:30	Feb.-Nov.	Sky Ridge Obs.	Carl H. Gamble, Route 1
NEW HAVEN	NEW HAVEN A.A.S.	4th Sat.	8:00	Sept.-June	Yale Obs.	J. J. Neale, 29 Fairmont Ave.
NEW ORLEANS	A.S. of N. ORLEANS	Last Wed.	8:00	Sept.-May	Cunningham Obs.	Dr. J. Adair Lyon, 1210 Broadway
NEW YORK	*A.A.A.	1st, 3rd Wed.	8:15	Oct.-May	Amer. Mus. Nat. Hist.	G. V. Plachy, Hayden Plan., *EN.* 2-8500
"	JUNIOR AST. CLUB	1st, 3rd Fri.	8:00	Oct.-May	Amer. Mus. Nat. Hist.	J. B. Rothschild, Hayden Plan., *EN.* 2-8500
NORFOLK, VA.	A.A.S. OF NORFOLK	2nd Thu.	8:00	All year	635 W. 29th St.	P. N. Anderson, 635 W. 29th St.
NORWALK, CAL.	EXCELSIOR TEL. CLUB	Thu.	7:00	All year	Excelsior Union H. S.	Geo. F. Joyner, 410 Sproul St.
NORWALK, CONN.	NORWALK AST. SOC.	Last Fri.	8:00	Sept.-June	Private houses	Mrs. A. Hamilton, 4 Union Pk., 6-5947
OAKLAND, CAL.	EASTBAY A.A.	1st Sat.	8:00	Sept.-June	Chabot Obs.	Miss H. E. Neall, 6557 Whitney St.
PHILADELPHIA	A.A. OF F.I.	3rd Fri.	8:00	All year	The Franklin Inst.	Edwin F. Bailey, *Rit.* 3050
"	*RITTENHOUSE A.S.	2nd Fri.	8:00	Oct.-May	The Franklin Inst.	A. C. Schock, *Rit.* 3050
PITTSBURGH	*A.A.A. OF P'BURGH	2nd Fri.	8:00	Sept.-June	Buhl Planetarium	Louis E. Bier, 837 Estella St.
PONTIAC, MICH.	PONTIAC A.A.A.	2nd Thu.	8:00	All year	Private homes	Harvey E. Orser, 34 Pine St.
PORTLAND, ME.	A.S. OF MAINE	2nd Fri.	8:00	All year	Private homes	H. M. Harris, 27 Victory Ave., S. Portland
PORTLAND, ORE.	*AST. STUDY GROUP	1st Wed.	8:00	All year	No. 9 Pacific Bldg.	H. J. Carruthers, 427 S. 61 Ave.
PROVIDENCE, R.I.	SKYSCRAPERS	1st Wed.	8:00	All year	Wilson Hall, Brown U.	Ladd Obs., Brown U., *GA.* 1633
RENO, NEV.	A.S. OF NEV.	4th Wed.	8:00	All year	Univ. of Nevada	G. B. Blair, University of Nevada
ROCHESTER, N. Y.	ROCH. AST. CLUB	Alt. Fri.	8:00	Oct.-May	Univ. of Rochester	M. L. Groff, 400 University Ave.
SAN DIEGO, CAL.	AST. SOC. OF S. D.	1st Fri.	7:30	Oct.-June	504 Elec. Bldg.	R. M. Lippert, Box 41, N. Park Sta.
SCHENECTADY	S'TADY AST. CLUB	Meetings suspended				C. H. Chapman, 216 Glen Ave., Scotia
SOUTH BEND, IND.	ST. JOSEPH VAL. AST.	Last Tue.	8:00	All year	928 Oak St.	F. K. Czyzewski, South Bend Tribune
TACOMA, WASH.	TACOMA A.A.	Meetings suspended				Grant Burke, Route 3, Box 349
TULSA, OKLA.	TULSA A.S.	Occasional meetings				V. L. Jones, 4-8462
WASHINGTON, D.C.	NAT'L. CAP. A.A.A.	1st Sat.	8:00	Oct.-June	U. S. Nat'l. Museum	Miss D. Harris, 1621 T St., N.W., *Du.* 4200
WICHITA, KANS.	*WICHITA A.S.	2nd Tue.	8:00	All year	E. High Sch., Rm. 214	S. S. Whitehead, 2322 E. Douglas, 33148
WORCESTER, Mass.	*ALDRICH AST. CLUB	2nd Tue.	7:30	All year	Mus. Natural History	W. C. Lovell, 158 Austin, 31559
YAKIMA, WASH.	YAK. AM. ASTR'MERS	3rd Tue.	7:30	All year	Chamb. of Comm. Bldg.	C. A. Zumwalt, 1019 Pleasant

†June, Jul., Aug., City parks ††Dinner meeting †††Nearest 1st-quarter moon

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PLANETARIUM NOTES

Sky and Telescope is official bulletin of the Hayden Planetarium in New York City and of the Buhl Planetarium in Pittsburgh, Pa.

★ **THE BUHL PLANETARIUM** presents in *October*, WEATHER—SECRET WEAPON NO. 1.

More than most of us realize, the course of the war in all theaters of operation has been largely governed by the weather, and by the meteorologist's knowledge of how to predict the weather before it comes. The Japs used weather as a weapon in the Pearl Harbor attack, as did the Germans in the blitzkrieg campaigns of Poland and France. This sky show tells the story of how the Allied Nations have perfected use of this weather weapon, turning it against the Axis to remarkable advantage and making it global in range. The battles of Midway and the Bismark Sea hinged upon the weather, as did the invasion of Normandy. Also, in this planetarium presentation, visitors discover many dependable weather signs—from various types of clouds to lunar haloes—which they can use for predicting the weather.

★ **THE HAYDEN PLANETARIUM** presents in *October*, SKIES OF AUTUMN. (See page 12.)

In *November*, COLOR IN THE SKY. Much of the beauty of our surroundings comes from color in the sky. The blue of the air above is an illusion. The light and color of the rainbow, like the blue of the sky, are simply the broken-up light of the sun. You will be interested to observe how many different kinds of color exist in the sky and to learn their causes.

★ SCHEDULE BUHL PLANETARIUM

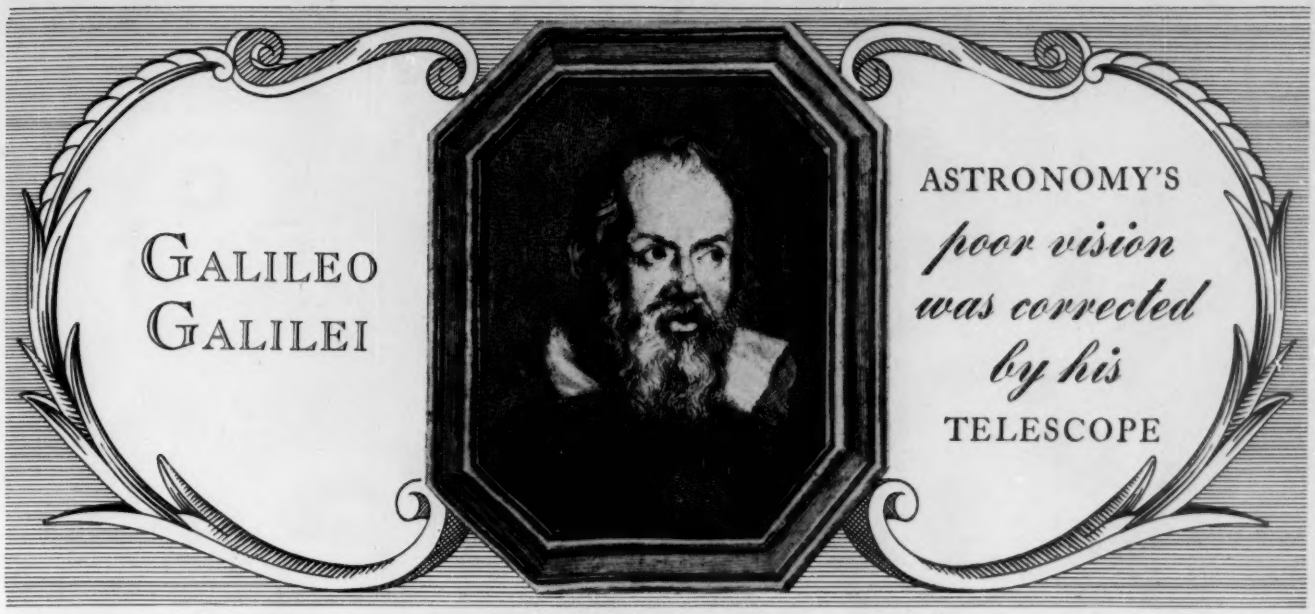
Mondays through Saturdays ..... 3 and 8:30 p.m.
Sundays and Holidays ..... 3, 4, and 8:30 p.m.

★ STAFF—*Director*, Arthur L. Draper; *Lecturer*, Nicholas E. Wagman; *Manager*, Frank S. McGary; *Public Relations*, John F. Landis; *Chief Instructor of Navigation*, Fitz-Hugh Marshall, Jr.; *Instructor, School of Navigation*, Edwin Ebbighausen.

★ SCHEDULE HAYDEN PLANETARIUM

Mondays through Fridays ..... 2, 3:30, and 8:30 p.m.
Saturdays ..... 11 a.m., 2, 3, 4, 5, and 8:30 p.m.
Sundays and Holidays ..... 2, 3, 4, 5, and 8:30 p.m.

★ STAFF—*Honorary Curator*, Clyde Fisher; *Associate Curator*, Marian Lockwood; *Assistant Curator*, Robert R. Coles (on leave in Army Air Corps); *Scientific Assistant*, Fred Raiser; *Lecturers*, Charles O. Roth, Jr., Shirley I. Gale, John Saunders.



GALILEO's genius for rapid solution of difficult problems is perfectly exemplified by his work with the telescope. Within several hours after hearing of the first telescope, he had mastered the principles involved. Within several months, he had made a scientific instrument of it.

In May of 1609, the day after news of the first telescope reached him, he built a telescope of plano-convex and plano-concave lenses and later, having arrived at the relation between magnification and foci of lenses, he constructed another telescope which magnified eight times. This he presented to the Doge of Venice in August, 1609.

Finally, Galileo produced an instrument magnifying thirty-two diameters, and with it initiated the future course of observational astronomy.

Today, 335 years later, other inquiring minds are searching for answers to the unsolved problems of astronomy, chemistry, metallurgy, photography, and vision. Aiding these leaders in industry, education and the armed forces are lenses and prisms in instruments of constantly increasing accuracy. It has been the privilege of Perkin-Elmer to collaborate in the improvement of many of those instruments and their elements.

From this collaboration have come ideas and production techniques that will enable Perkin-Elmer to provide post-war optical instruments that will bring new accuracy to analysis, control, inspection and observation.

WHAT PERKIN-ELMER MAKES

Custom-built optical instruments for industrial analysis, control, and inspection.

New optical devices to solve specific problems, such as the all-purpose infra-red spectrometer.

Special elements such as fine lenses, prisms, flats, photographic objectives, interferometer plates, retardation plates, Cornu prisms, Rochon prisms, Nicol prisms.

Perkin-Elmer is now 100% in war work, but after the war will resume manufacture of such peace-time products as Schmidt cameras, refracting and reflecting telescopes, equatorial mountings, oculars, direct-vision prisms, polarizing eye pieces, and other equipment.

THE PERKIN-ELMER CORPORATION

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